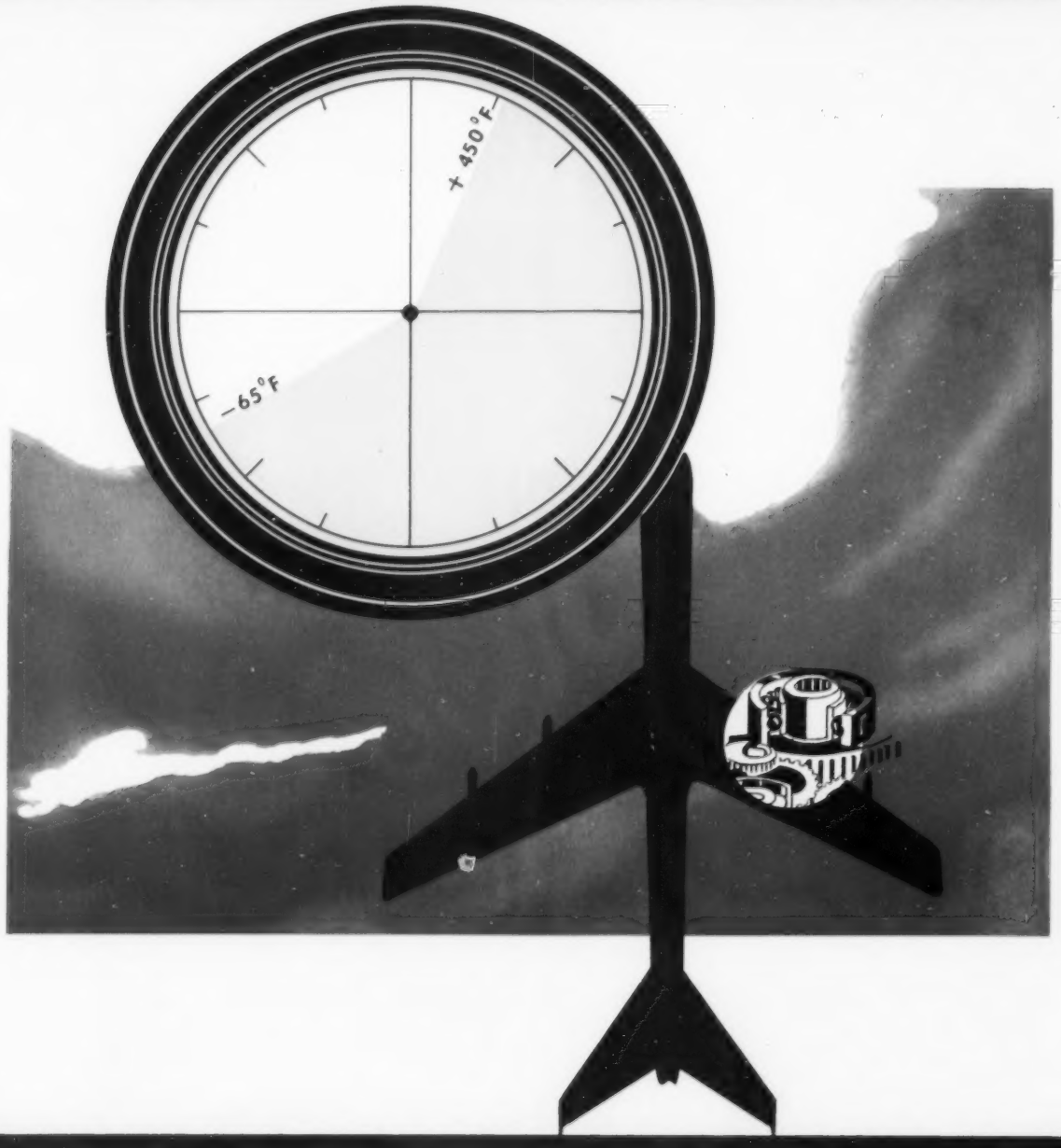
APRIL • 1954

NLGI Spokesman

Journal of National Lubricating Grease Institute



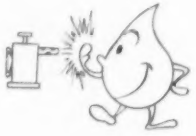
In This Issue

STAYS

ON THE JOB FOR SERVICE STATIONS

won't wash out

won't squeeze out



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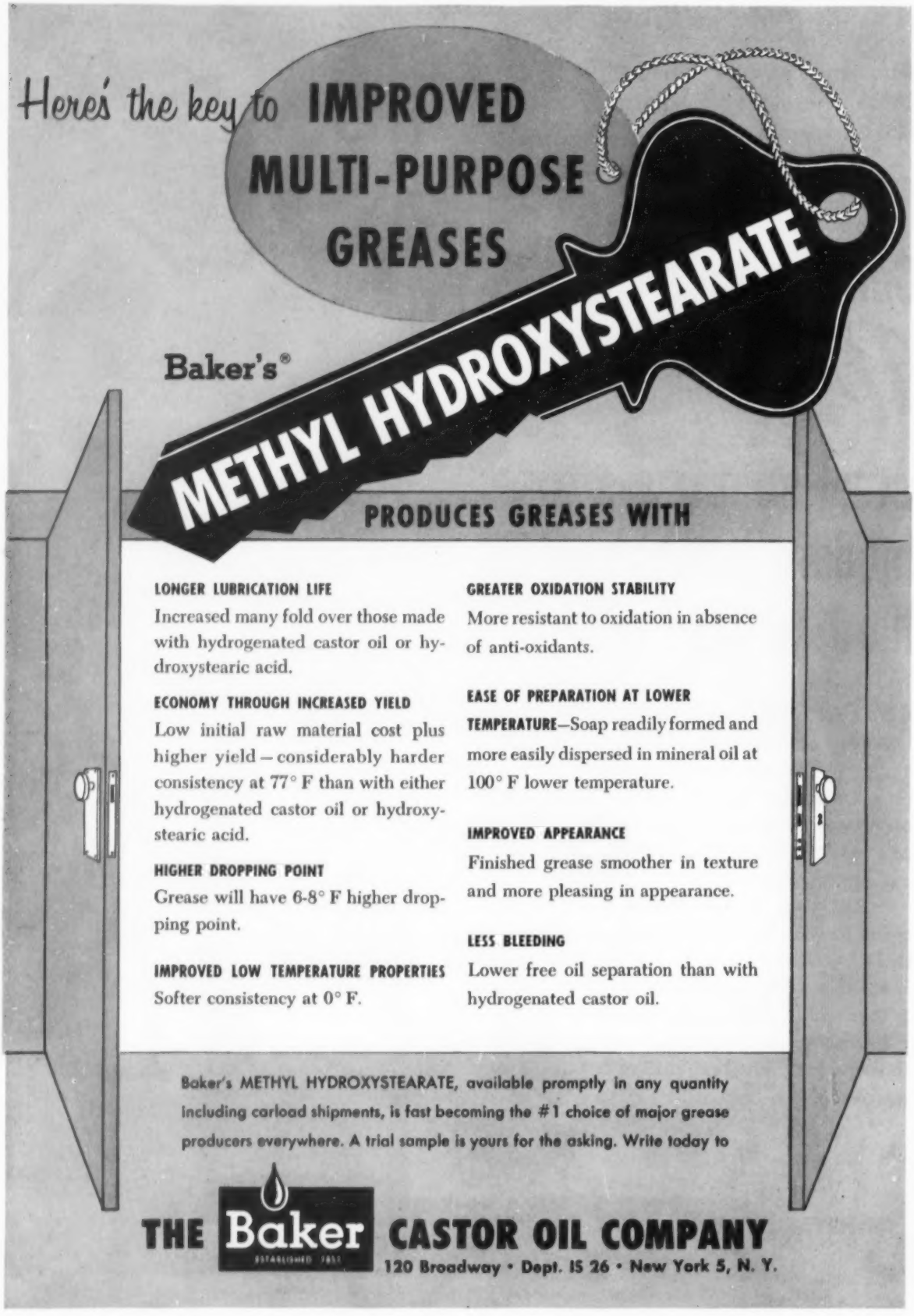
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President's page

by W. M. MURRAY, President, NLGI

"PROGRESS REPORT"

WELCOME to the new Executive Secretary of NLGI, Mr. "Tom" W. H. Miller! He comes to us well recommended. "Tom" has interesting initials because in long distance parlance "W.H. on the line" means that the connection is complete and that the interested parties are ready to go. In the next issue of the "SPOKESMAN" there will probably be an article dealing with the biography of this outstanding young man, a gentleman who I am sure you will all be glad to know about and meet. He is going to have every opportunity, and our help, in establishing himself with the Institute and with the industry.

The Board of Directors met in Detroit on March 1st. Reports from committee chairmen unanimously approved by the Board show that the creative phase of our operations is not neglected. The Motion Picture Committee, Technical Committee, and the Spokesman Committee have been extremely active in a good productive way. The Finance, Membership, and Program Committee reports indicate continued progress for the Institute.

Vice President Lane's Program Committee may be of particular interest because it is rather remarkable to have a comprehensive program for the fall convention almost complete at this early date. The polishing process should bring the 1956 Program to top place in NLGI annals.

It is gratifying to work with members who contribute so generously of their time and effort in the making and support of institute policies.

I take this occasion to extend best wishes to Mr. Harry Bennetts, our former Executive Secretary. We hope that he will be very successful in new endeavors.

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NLGI Spokesman

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IN THIS ISSUE

ABOUT THE COVER

That speedy jet on the cover isn't going far—without the proper lubrication. Continuous work by our industry is directed to developing a more efficient grease for the ultra high speeds and extreme temperature ranges required for the speed of jets.

Significance of the temperature gauge and bearing cross-sectioned on right wing of the plane is to illustrate capabilities of a new synthetic oil grease claimed to satisfactorily lubricate ball bearings in ultra high speed with temperature extremes ranging from—65°F. to 450°F. Read High Temperature Ultra High Speed Grease Lubrication appearing on page 8.

High Temperature *Ultra High Speed* Grease Lubrication

By J. P. Dilworth and J. R. Roach

The Texas Company, Beacon, N. Y.

The purpose of this paper is to discuss the performance of a new mixed soap-solid thickened synthetic oil grease. This new product contains a non-silicone type oil and is the result of continuing research work directed towards the development of wide temperature range greases satisfactory for high speed bearing lubrication. This grease will satisfactorily lubricate ball bearings over the approximate range of −65 to 450°F.

Figure 1 is an electron micrograph showing the mixed thickener structure of this type product. This combination of soap and non-soap thickener makes an important contribution to the excellent performance characteristics of this grease.

The properties of the synthetic oils used in greases for high temperature high speed application differ considerably from those used in low temperature greases. This is illustrated in Table I. It will be noted here that the synthetic oil used for high temperature grease has somewhat higher flash and fire points, and considerably higher viscosities at −65, −40 and 210°F. than does the synthetic oil used for MIL-G-3278 low temperature grease. Evaporation characteristics of the synthetic oil used for high temperature grease are also better than those used for low temperature grease.

J. P. Dilworth, left, and J. R. Roach inspect high speed test results before presenting article at NLGI Annual Meeting.

Typical physical and chemical properties for the grease under discussion are shown in Table II. It has been made in NLGI grades 0, 1, and 2 and gives satisfactory high temperature and high speed bearing performance in all three grades. The selected range appears to be satisfactory for most applications. On the basis of 100,000 stroke penetration tests, it is not particularly shear stable. The dropping point of 381°F. shown here is typical when run by the ASTM method. This may seem strange for a high temperature grease, but we have found that this is not an actual melting point but a bleed point. In tests conducted using an aluminum block we have found that this grease does not actually melt until a considerably higher temperature is reached. This grease does not corrode copper. It is resistant to water washing and prevents rusting of steel in the presence of salt water. Evaporation at 300°F. is low and bleeding at 300°F. is considered reasonable. In the ASTM Bomb Oxidation Test at 300°F., this product exhibits some pressure drop. None of these static tests are considered particularly significant when it comes to predicting or measuring actual grease performance.

The low temperature properties of this grease, designated in subsequent tables as Grease A, are illustrated in Table III.

Some tests for present MIL-G-3278* and MIL-L-3545† specification grease are also shown for comparison. The apparent viscosity for this product at −40°F. is somewhat higher than for MIL-G-3278 type greases at −65°F. This grease has, however, much better low temperature properties than MIL-L-3545 grease as shown by starting and running torques. Here, Grease A at −40°F. shows approximately the same values as MIL-L-3545 greases do at 0°F. Low temperature torque values again show that Grease A is considerably better than MIL-L-3545 greases but not as good as MIL-G-3278 type products. It is anticipated that Grease A will, however, operate at −65°F. in a number of aircraft accessories where torque requirements are not too severe. The ability of a grease to lubricate these accessories at a given low temperature depends on the power

*Grease; Aircraft and Instrument (for Low and High Temperatures) †Lubricating Grease; High Temperature

available. This was clearly illustrated in a presentation on "Low Temperature Operation of Aircraft Accessories" made at the ASLE meeting in April this year.[1]

The high temperature performance properties of this product are shown in Table IV. The values shown here for tests at 10,000 r.p.m. in No. 204 bearings are aver-

TABLE I
Properties of Synthetic Oils for Low and High Temperature Greases

MIL-G-	3278*	*High Temp.*
Use	*Low Temp.*	*High Speed*
Sp. Gr. 60/60°F.	0.917	0.955
Flash, COC, °F.	435	465
Fire, COC, °F.	485	535
Kin. Vis. at −65°F. cs.	15,000	150,000†
−40°F. cs.	1500	27,000
210°F. cs.	3.38	9.2
Vis. Index	150	140
Pour Point, °F.	Below −65	−65
Evaporation, 4 hours at 400°F.	5.9	2.7

*Grease; Aircraft and Instrument (for Low and High Temperatures.)
†Extrapolated

TABLE II
Typical Physical and Chemical Properties

ASTM Penetration	
Worked, 60 strokes	335
Dropping Point, °F.	381
*Copper Corrosion, MIL-L-3545**	
24 Hr. at 212°F.	Pass
Dynamic Water Resistance	
Grease Loss, %	2.5
Salt Spray Test, MIL-G-15793†	
Rust in 50 Hr., %	None
Evaporation	
100 Hr. at 300°F., %	3.4
Oil Bleeding	
30 Hr. at 300°F., %	15
ASTM Bomb Oxidation	
Pressure drop in 50 Hr. at 300°F., lb.	27

*Lubricating Grease; High Temperature
†Grease, Instrument

TABLE III
Low Temperature Properties

	Grease A	*MIL-G-3278*	*MIL-L-3545*
Apparent Viscosity at, °F.	−40	−65	....
Poises at 20 sec. −1	9000	6100	....
Starting and Running Torques, g-cm.			
Temp., °F.	−40	−65	0
Start	700	389	800
Run	200	85	225
Low Temp. Torque (2000 g-cm.)			
Temp. to reach,			
10 sec./rev., °F.	−50	−80	0
>120 sec./rev., °F.	−80	−100	−20

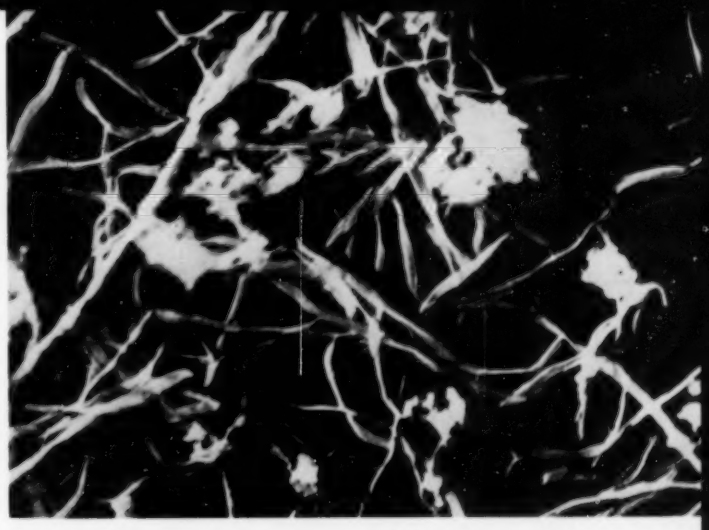


Figure 1—Electron micrograph of mixed thickener structure of wide temperature, high speed grease.

ages of a number of tests for each type of product. MIL-G-3278 type greases have an upper useful temperature limit of about 300°F., for short periods of time. MIL-L-3545 specification greases will operate considerably longer at 300°F. but for only short periods at 350°F. On the other hand, Grease A will operate for long periods of time at 350°F., for reasonable periods of time at 400°F., and for short periods even at 450°F. Slower speed tests using larger bearings, such as in the Navy Silicone Motor Generator Test set, indicate that Grease A is much better than either of the other type products. This new grease ran for over 5,000 hours at 300°F. in this test. This far exceeds the 2000 hours required by MIL-L-15719A[1].

We know that some greases prepared with silicone type oils will operate for longer periods of time than Grease A at high temperatures when speeds are 10,000 r.p.m. and under. Most of these products will not satisfactorily lubricate ball bearings when the speeds are above 10,000 r.p.m. when using No. 204 ball bearings. The performance of Grease A in ultra high speed ball bearings is shown in Table V.

At 35,000 r.p.m. using 204 bearings, Grease A and the MIL-L-3545 type grease both pass a 64-hour endurance

TABLE IV
High Temperature Performance

	Grease A	*MIL-L-3545*	*MIL-G-3278*
High Temp. Performance Test, 10,000 r.p.m., 204 Brg.			
Avg. Hours to Failure at			
250°F.	....	2500+	2000
300	....	950	300
350	1050	151	....
400	290	....	....
450	65	..	....
Navy Silicone Motor Generator Test, MIL-L-15719A, 1750 r.p.m. 310 Brg.			
Hours to Failure at 300°F.	5386	900	150

[1]"Low Temperature Operation of Aircraft Accessories," E. A. Baniak, and R. S. Barnett, Beacon Laboratories, The Texas Co., presented at the National Meeting of ASLE, Chicago, Ill., April 13-15, 1955.

test when using 80 lb. of thrust load to generate approximately 200°F. bearing temperatures. MIL-G-3278 greases will not run the full time under these conditions. Greases prepared with various silicone oils using the same thickener as used in Grease A will consistently run less than 2 hours time to bearing failure under these same conditions. In another type of test using a lighter load and external heat to develop 300°F. outer bearing race temperatures the new product will operate better than 300 hours at 35,000 r.p.m. In this case, the MIL-L-3545 type grease does not operate nearly so well and MIL-G-3278 type greases are unsatisfactory. In other words, when we bring speed and temperature together in the same type of test, the new product out-performs the others by a considerable margin. In preliminary tests in another type unit, using Series 100 bearings, at 65,000 r.p.m. and 250°F. we have obtained better than 500 hours of operation with Grease A. It is now being tested at 50,000 r.p.m. in 204 bearings under light load. These data show that the new product is capable not only of lubricating at high temperatures but is also capable of lubricating ball bearings in the ultra high speed range. This is important! Excessive temperatures in aircraft accessory equipment can sometimes be eliminated by changes in design but maximum power output usually requires full speed.

Load carrying capacity and wear characteristics are compared in Table VI. Grease A has an average Mean Hertz Load of 40 in comparison with the 18 to 20 usually obtained on MIL-G-3278 type greases. In the Navy Gear Wear Test, using both steel on brass and steel on steel, the wear characteristics of the new product are approximately equivalent to the MIL-G-3278 type grease. In the Four Ball Wear Test, Grease A shows slightly better wear prevention characteristics than does the other product. Thus, it would appear that in Grease A we have the good combination of high load carrying capacity, coupled with low wear.

The tests that have been discussed up to now are, for the most part, laboratory bench type tests. The proof of the usefulness of any product, however, awaits testing in full scale equipment of the type that it is intended to lubricate. Grease A has been tested in full scale aircraft accessory equipment by the manufacturer. Representative tests are shown in Table VII. Here, two different types of fuel pumps containing 104 bearings were used. In one case, the r.p.m. is constant at 25,000 and the temperature at 275°F.; in the other case, the operation is cyclic from 25,000 to 55,000 r.p.m. at a temperature of 315°F. In the first unit practically all the MIL-G-3278 type grease is gone at the end of 50 hours of operation. Grease A when tested in the same equipment, exhibits practically no leakage in 50 hours and lubrication is satisfactory. In the other type of equipment, when lubricated with MIL-G-3278 grease, the bearings would either fail before reaching the 350 cycles or failure would be imminent in the event that 350 cycles were reached. The same unit lubricated with Grease A and tested under identical conditions has operated satisfactorily through 350 cycles with apparently no deterioration either of the bearings or the grease.

A further test in full scale aircraft accessory equipment is summarized in Table VIII. In such a unit containing number 203 bearings, operating at 25,800 r p.m. and 230° F. almost no grease is left on the bearings at the end of 50 hours when lubricated with MIL-G-3278 type grease. With Grease A, however, practically no leakage occurs and the bearings and the grease remain in good condition.

Thus, it appears from these tests in full scale aircraft accessory equipment, that this grease is capable of lubricating ball bearings over a wide range of temperatures and speeds. There is no government specification at the present time covering this new type of grease. It appears, however, that this product will have an important place in aircraft accessory lubrication.

TABLE V

High Speed Performance

	Grease A	*MIL-L-3545*	*MIL-G-3278*
High Speed Spindle Tests *35,000 r.p.m., 204 Brg.*			
Avg. Hours to Failure at			
200°F., 80 lb. thrust load	64+	64+	46
300°F., 20 lb. thrust load	304	63	3

[1]Lubricating Grease (High Temp., Electric Motor, Ball and Roller Bearings)

TABLE VI

Load Carrying and Wear Characteristics

	Grease A	*MIL-G-3278*
Mean Hertz Load, Kg.	40	18
Navy Gear Wear Test		
Steel on Brass		
Mg. wear/1000 cycles		
5 lb. load	1.4	1.4
10 lb. load	2.4	2.4
Steel on Steel		
Mf. wear/10,000 cycles		
7 lb. load	3.7	4.0
Four Ball Wear Test		
30 Min. at 200°F.		
Scar dia., mm.		
10 Kg. load	0.521	0.584
28 Kg.	0.696	0.737
40 Kg.	0.838	1.730

TABLE VII

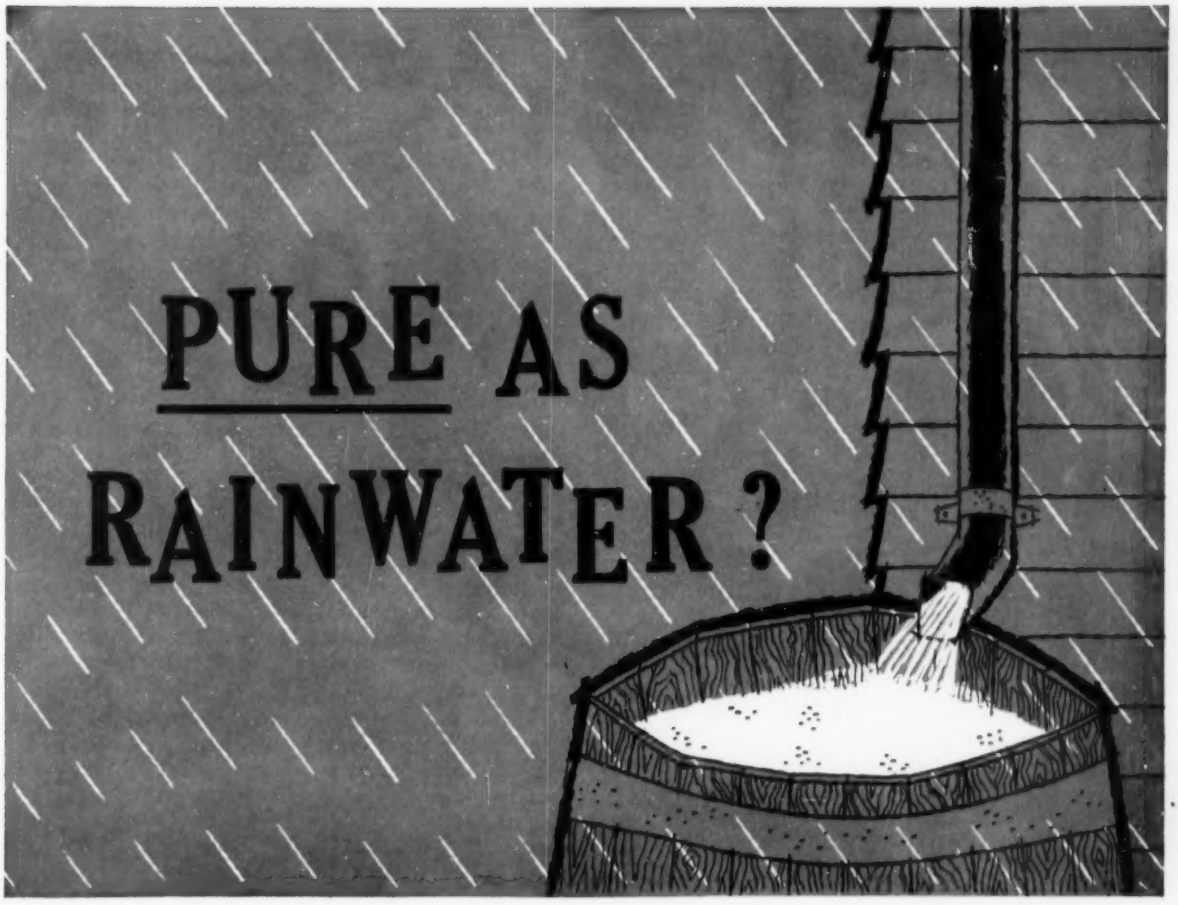
Tests in Full Scale Aircraft Accessory Equipment

Equipment Type	*Fuel Pump*	*Fuel Pump*
Bearing Size	104	104
Speed, r.p.m.	25,000	25,000 to 55,000 in 2½ min. cycles
Temp., °F.	275	315
Operating Time	50 Hr.	350 cycles
Performance		
MIL-G-3278 Grease	High Leakage	Bearings Fail
Grease A	No Leakage	Bearings and Grease O.K.

TABLE VIII

Tests in Full Scale Aircraft Accessory Equipment

Bearing Size	203
Speed, r.p.m.	25,800
Temp., °F.	230°F.
Operating Time	50 hr.
Performance	
MIL-G-3278 Grease	High Leakage
Grease A	No Leakage



In olden days before smog was invented, perhaps rain actually was pure enough to merit this saying.

But today *"pure as a Metasap Stearate"* would far more accurately describe perfect purity—that helps you make specialty greases 6-ways better with sure, dependable performance.

For the varied Metasap Stearates produce greases that are smoother in texture, more economical—and moisture-proof, temperature-resistant and water-repellant too! They do a better job... under toughest conditions anywhere in the world!

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PICKER LUBE PAYOFF

By John Y. McCollister
United Petroleum Corporation
Omaha, Nebraska

THE CORN BELT is often considered to be the backbone of American agriculture. As agriculture has mechanized to raise the productivity per farm worker nowhere has this revolution been more spectacular than in the rich, fertile valleys of the Missouri and Mississippi rivers. In 1930, *Fortune* magazine estimates there were 50,000 corn pickers in the U.S.A. Now the number is 13 times that, or 650,000. Man hours per 100 bushels of corn produced declined from 127 man hours in 1930 to only 34 in 1955. This many fold increase in the use of farm equipment has of course developed a tremendous market for lubricants.

Our Company is fortunate to be so well situated to serve this market. As the market has grown, so has our Company.

As with many organizations our Company both markets under its own brands and manufactures lubricants for others under their own brands. This paper is concerned only with the marketing of one of our products under our brand name, "PICKER-LUBE." It is marketed in Iowa, Nebraska, the Dakotas, Minnesota, Missouri and Kansas through approximately 1000 oil jobbers and implement dealers. Eight salesmen serve these customers.

In this area a recent survey made by *Capper's Farmer* reveals that nearly every other farm has a corn picker. The statistics below show the number of corn pickers per 1000 farms in several midwestern states.

South Dakota	602
Iowa	571
Nebraska	550
Minnesota	345
Kansas	137
Missouri	130

Immediately following World War II several things became apparent.

1. The number of corn pickers was increasing rapidly.
2. The corn picker uses more grease than any other piece of equipment on a corn belt farm.
3. The marketing of a special purpose grease had, it seemed at the time, great sales appeal.

With these conclusions in mind, we developed a special package identification and the brand name "Picker-Lube." Initially, the design was silk-screened onto a standard 5 gallon, lug-covered, red enamel pail. As volume sales developed, it became practical to use a lithographed 5¼ gallon container.

The selection of the grease formula was influenced by these considerations.

A. A corn picker is operated during a season of the year when there are wide fluctuations in temperature. It can be well below freezing in the morning and hot by noon. Good pumpability, therefore, was a must.

Author J. Y. McCollister presenting article at NLGI Annual Meeting in Chicago, October 1955.

B. A corn picker, like all farm implements, of necessity must sit out, exposed to the elements. Therefore, water insolubility was a requirement.

C. The great majority of farm implement bearings have moderate operating temperatures. A high dropping point was therefore not a requirement.

D. A corn picker is often operated over rough frozen ground and the nature of its operation involves an uneven load on bearings. As a result, bearings are subject to shock and heavy momentary loads. It was felt that the incorporation of the proper amount of colloidal graphite would give additional protection to the bearings under these conditions.

E. A corn picker is lubricated at least twice each day. Because corn picking time is frequently a dry dusty season, one of the functions of the grease was to wash out the dust that inevitably finds its way to the bearings.

As a result of these considerations, Picker Lube was manufactured using Calcium soaps, a 55 second at 210° viscosity oil, a tackiness agent, colloidal graphite and several oil additives. The consistency was a light N.L.G.I. #1.

Subsequent events demonstrated our good fortune in the selection of the Picker Lube formula and only minor changes have been made in the last 9 years.

Before our introduction of Picker Lube, the fall of the year was not responsible for very much grease business. The spring and summer were our busy seasons and we lived through the last 6 months of the year hoping that we didn't lose all the profit we made during the first 6 months. When Picker Lube was marketed in 1946, this began to change. The late summer and early fall began to be something we looked forward to with anticipation rather than with dread. Today our last 6 months are approximately equal to the first 6 months.

To begin with in 1946 our promotional activities were few. The salesman was responsible for developing the business and the Company did little in an organized way to help him. The main selling argument was, of course, "Here is a lubricant especially designed for corn pickers." And this approach brought in some business.

It was felt that something more could and should be done. Anyone who deals with the farm market is well aware of the power that premiums have. In 1948, it was decided to test a program in one area of South Dakota with a simple straight forward premium plan.

With each 40 pound pail of Picker Lube the Company would provide at no cost to the dealer or to the farmer, a guaranteed mechanical pencil. In addition, the Company would prepare a direct mail card, imprint it with the dealer's name and mail it to each rural boxholder in the dealer's trade territory. The only cost to the dealer was the 1½c postage for each card which was invoiced to him at the same time we shipped the grease.

This simple plan developed a tremendous response in the South Dakota area where it was tested. The next year, 1949, the same plan was presented over the entire territory with excellent results.

The basic plan has been the same each year since. Several times we have tried other premiums feeling the pencil was losing its appeal. We have always come back to it. The selection of the right premium is very definitely one of the most important aspects of this program. In our experience we have found that the premium you give away free must be of high quality. If you give away a pencil make very certain it's the best pencil you can find. If your premium is not of high quality it will reflect adversely on your product.

There is no question in our mind that next year—or the year after—or the year after that—that we must find something new. It isn't going to be easy to replace the pencil.

Although the basic plan is unchanged each year we add to it. This year we have had the most complete program yet. These are the essential parts.

Between July 1, and October 31, we gave away free mechanical pencils with each 40# pail of Picker Lube provided a minimum of 20 pails were ordered. We provided a direct mail card on the same basis as in years past. We paid for the preparation of the card, the dealer paid the postage. We prepared several point-of-sale posters that seemed to do much to create interest. We gave each dealer an ad mat to use for local newspapers. We provided copy for them to use for radio spot announcements.

This year there were 2 complications not present in previous years. One complication is the result of the popularity of our lithium base grease competing with Picker Lube. Although sales of Picker Lube still increase each year, the sale of our lithium grease increases even faster. This year we made the entire campaign around both greases although Picker Lube got top billing. A normal order from a dealer this year would be in the ratio of 4 pails Picker Lube to each pail of lithium. During the spring and summer the ratio is more favorable to lithium.

A second complication results from the fact that in the 10 years we have sold Picker Lube it has been a success. Normally you don't complain about this, but because it has been successful it has increased the amount sold of all our products—*but grease* relatively more than motor oils. We sell between 3 and 4 pounds of grease to each gallon of oil sold—a ratio which is evidence of an opportunity for the better sale of motor oils. The farmer will use approximately 1 gallon of oil to a pound of grease. Obviously he is buying our grease and a competitor's oil. This distressing situation had to stop.

In the last year or two, we have observed much more activity by most petroleum marketers in what we call "Country Canvassing." People who sell oil and grease are out working the country harder than they have in a long time.

This activity is usually carried on during the time between the end of the small grain harvest and before corn picking. During this 2 to 3 months lull in farm activity, we and others try to sell our customers up to a year's supply of lubricants with delivery to be taken by the farmer during the winter and the early spring. It concentrates the dealer's selling efforts during a period which is most convenient to him and most convenient to the farmer who has more time to talk to the dealer. Of course, any effective selling program must continue throughout the entire year, but this is the time for the big push.

It fits together with the Picker Lube program beautifully. Picker Lube is our best known product. A more intensive effort to tie Picker Lube to our motor oils could not fail to be successful. We felt that many dealers who sold Picker Lube, but who sold a competitor's oil, would realize that here was the beginning of an oil program which would yield the same sales increases for oils they had enjoyed with Picker Lube. We urged them to get on the bandwagon, and many did.

As an added incentive to encourage the maximum effort we developed a merchandise incentive program which awarded points to those dealers for the motor oil they sold between August 1 and October 31. These points were used to buy merchandise prizes selected from a group of items. We tried to keep the program as simple as possible. The rules laid out were standard and have been used for many years by others. There is no need for a detailed explanation here.

The program then consists of the following:

1. A direct mail card which sells Picker Lube, Lith-O-Lube and our heavy duty motor oil. The cards were mailed approximately September 15.
2. A guaranteed mechanical pencil given free with each 40# pail of Picker Lube and Lith-O-Lube.
3. The dealer must buy a minimum of 20 pails of grease before he receives the cards and pencils. The average dealer will sell over 30 pails and a great many sell over 100 pails each fall.
4. Point-of-sale banners and posters.
5. Advertising mats for use in local newspapers.
6. A merchandise incentive program which encourages the dealer and his men to tie in the sale of a 30 gallon drum of motor oil with the sale of a pail of grease.
7. The entire program was put in an attractive packet to be left with the dealer after the salesman had reviewed it with him.

The first week in July our semi-annual sales meeting was held. We presented the material to the salesmen in the same way the salesman presents it to the dealer. As the program unfolded the enthusiasm developed. We knew we had the best program available anywhere in the cornbelt. The only thing left to do was to tell as many dealers about it as possible.

There are many times when this program seems expensive to us. When we begin figuring the promotional cost per pail of grease we sometimes hesitate. The cost will approximate 15% of the dealer cost for a 40 pound pail of Picker Lube. But it is successful and we feel, therefore, the expense is justified. For every 8 cards that are mailed we sell a 40 pound pail of grease. This is a remarkable return on a direct mail card.

We feel the benefits of the program more than justify the cost. Some of the benefits are:

Because this program is somewhat unique in our area, a dealer is very much impressed with it. We deal only in lubricants and, therefore, bring to the oil jobber less opportunity for profit than the fuels supplier or, in the case of an implement dealer, less than his line of implements. If we are to gain any attention from the dealer under these circumstances, we must have a program that demands his attention. The large number of new accounts gained in the last few years is evidence of the dealer's high opinion of the program.

Dealers sales have increased, which makes our accounts less vulnerable to competitive activity. A very good example of what the promotional campaign does for the dealer was demonstrated by one of our customers in Northwest Iowa last year. The customer had sold Picker Lube each year, but had not used the direct mail card. Normally his sales were approximately 100- 40# pails. Last year when he mailed the direct mail cards, he sold 178- 40# pails during the campaign period. All other factors affecting his sales were equal. What better evidence of the pulling power of this campaign is needed?

It gives confidence and enthusiasm to our sales force. They *know* they have the best program. They *know* they will get an attentive audience from prospective customers. The salesmen make more customer calls and more prospect calls—the stuff from which our future is made. In short, the salesman is more productive.

It is impossible for us to match the large scale advertising expenditures by major companies with whom we compete for the farmer's business. In the first place our distribution is regional. In the second place we manufacture and market only lubricants. We do not have a large number of products to share the cost and to reap the harvest. We must carefully aim our shots at a smaller target. This program outlined here seems to do that for us.

One of the important benefits already mentioned which deserves repeating is that the Picker Lube program has helped smooth out seasonal fluctuations in sales. The better utilization of plant facilities has been very important to us.

This program makes our sales and our dealer's sales less subject to bad crops. In Nebraska and portions of the remainder of our territory, we had a very poor corn crop. In addition farm income generally is down from 5 to 10%. The dealer needs help to sell anything to the farmer. We provided this help. Dealers are more responsive to this kind of a program in poor times than they are in good times. As a result, our business proceeds on a more even keel than would otherwise be the case.

In summary, the farm market for lubricants has grown tremendously in the last few years. In the corn belt one of the most important uses for lubricants is the mechanical corn picker. Our major promotional efforts have been directed to establish our Picker Lube.

The promotion as presented here emphasizes the use of a high quality mechanical pencil, a direct mail campaign and point-of-sale advertising. The program has been successful in establishing Picker Lube as one of the largest selling lubricants in our marketing area. It has not only increased the sale of Picker Lube but has also developed a greater market for all our products.

It seems evident to us that the sales of Picker Lube will continue to increase but that the future will see the even faster growth of the market for multi-purpose lubricants. The development of an effective program for multi-purpose lubricants or any other product we market will be patterned after our Picker Lube program.

The farm market is intensely competitive. The success of any company interested in this market will be completely dependent on the quality of its promotional activities.

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LITHIUM CARBONATE • LITHIUM HYDROXIDE • LITHIUM BROMIDE • LITHIUM CHLORIDE and other LITHIUM CHEMICALS

CENTRALIZED

Figure 5—"The push button operates a three-way valve . . . when pressed, and vents to atmosphere when released after signal light indicates cycle is complete."

CHASSIS LUBRICATION

The Meeting Committee has invited me to tell you about some recent developments in centralized lubrication of the chassis bearings of motor vehicles.

As you know, centralized chassis systems were rather widely used in the late Twenties but disappeared from the American scene in the early Thirties—with the result that nearly all chassis bearings are being lubricated today just as they have been for more than 25 years.

In the intervening years, manufacturers of lubricating equipment developed a wide variety of centralized systems for Industrial machinery. Today, machines equipped with automatic lubricating systems are the rule rather than the exception.

By CARL H. MUELLER
Lincoln Engineering Company
St. Louis, Missouri

It was the present day problems of fleet lubrication that brought about a revived interest in centralized chassis lubrication. Rising labor costs, requirements for greater availability and the practice of inter-lining brought about an active interest in the possibility of automatic lubrication for over-the-road trailers.

It is not difficult to lubricate a trailer by conventional methods but it is difficult to adhere to good maintenance practice. In many cases, because of urgent shipping schedules, the trailer can only be lubricated while at the loading dock.

This of itself would not be too serious but an inter-lined trailer may be away from the home garage for two or three months at a time, and meanwhile may be pulled by several foreign carriers. Thus the normal practice of lubricating at stated intervals of time or mileage is practically out of the question.

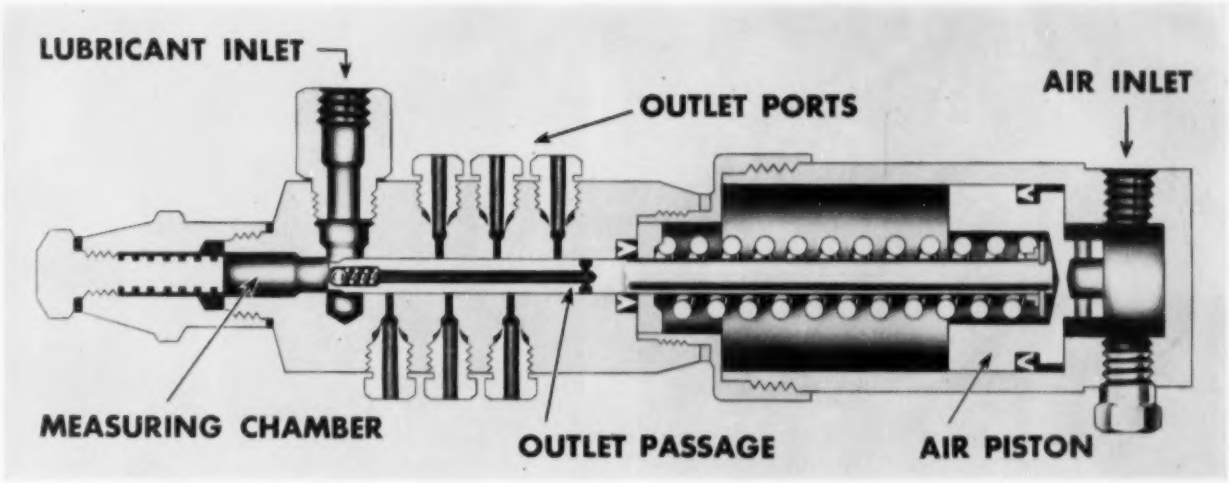


Figure 1—"The measuring pump serves as both pump and distributing valve."

We were well aware of this because a major part of our business is the manufacture of conventional lubricating equipment for fleets and this problem with the inter-lined trailer was constantly brought to our attention.

About four years ago we began a test program in co-operation with several fleets operating from St. Louis. The first step was to select the type of centralized lubricating system.

There are two general classes of centralized lubricating systems: those which measure the lubricant at the source and those which measure the lubricant at the bearing. There are, of course, many variations of these themes. Among these variations are high pressure, low pressure, positive displacement, feed regulation by restriction and many others.

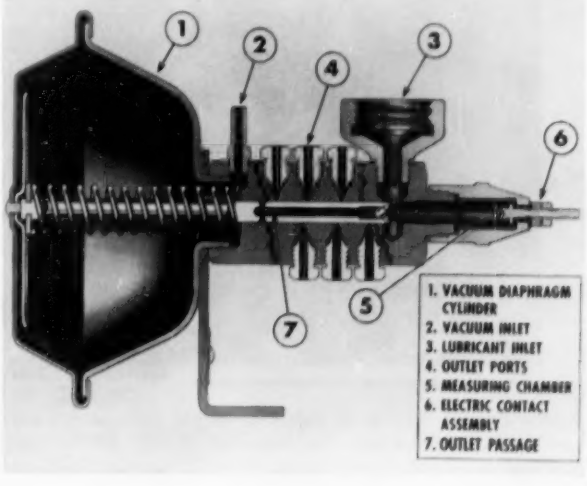
As a result of our observations and discussions with fleet operators, we concluded that a system for trailer lubrication should have the following characteristics:

1. Measurement at the source in order to provide an individual line from the pump to each bearing. A broken line thus affects only the associated bearing.
2. Positive displacement to insure equal delivery to all bearings regardless of resistance offered by particular bearings.
3. High pressure to insure lubricant delivery to bearings at low temperatures when line resistance is high.
4. Fully automatic, not requiring operation by the driver. An inter-lined trailer might be pulled by half a dozen drivers before returning to home base and it would be difficult to pass on operating instructions.

The measuring pump, in schematic section, is shown in Figures 1 and 2. You will note that this unit serves as both pump and distributing valve. As the plunger is forced forward by the air cylinder or vacuum diaphragm it first crosses the inlet port, trapping lubricant in the measuring chamber. Further movement of the plunger forces lubricant through the hollow plunger to cross drilled ports which connect with the distributing groove. Width of the groove is equal to the distance between adjacent ports. When the groove has passed No. 1 port, that port is sealed off and the groove connects with Port No. 2 and so on. When the plunger stroke is completed, the air cylinder or vacuum diaphragm is vented to atmosphere allowing the plunger to return by spring pressure. Lubricant then flows through the inlet port, refilling the measuring chamber. Figure 3 shows a typical trailer installation.

Actuation of the pump is controlled by brake application, either directly or through a counter adjustable to various ratios such as every five, ten, etc. brake applications. Systems on over-the-road vehicles are generally tied into a brake line and cycled at each brake application. Vehicles operated on relatively short hauls with frequent stops are usually equipped with counters. Test installation results were encouraging and it was decided to undertake a large scale test using new trailers. This group of trailers was operated approximately 60,000 miles per trailer and brought in for inspection. Repair costs averaged only 10 per cent of the previous average with the same type of trailer. Operating costs of the system were 30 per cent less than cost of conventional lubrication. Concurrent with the trailer tests a trial installation was made on a number of transcontinental buses. Here the

Figure 2—"As plunger is forced forward by vacuum diaphragm . . . it traps lubricant in measuring chamber."



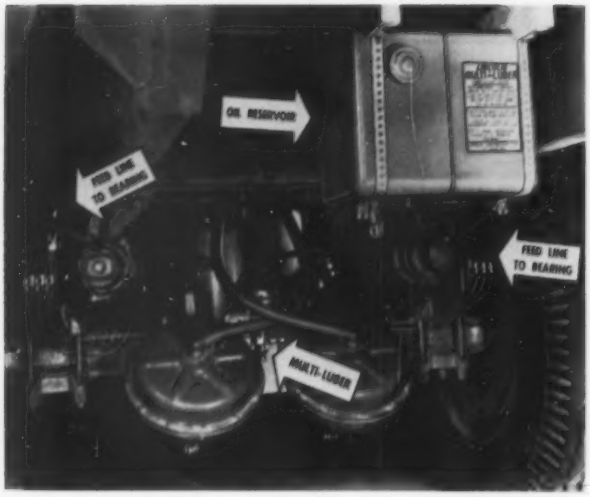


Figure 3—"A typical trailer installation of centralized lubrication."

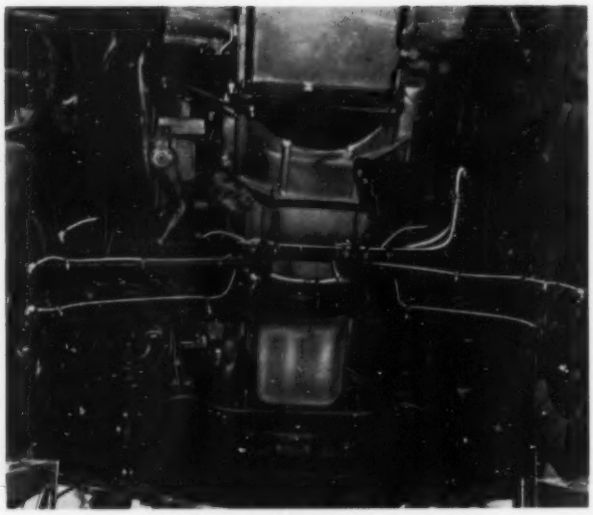


Figure 4—"Centralized lubrication installed in a 1955 Lincoln car."

principal factor was driver's complaints of hard steering. Several buses were equipped with systems servicing the steering linkage and spindle bearings only. Driver complaints were eliminated and, at this writing, bearings have run approximately double the normal mileage and are still in good condition.

In the course of our test work we were frequently asked, "Why won't this work on my car?" A number of cars had been equipped and were operating satisfactorily but the installation was considered to be too expensive for passenger cars. However, two important developments changed the picture, development of ball joint suspension and the development of a new type of nylon tubing. The smaller number of bearings in the ball joint suspension made it possible to service a car with one pumping unit and the nylon tubing provided low cost, durable, flexible connections. Nylon tubing made it possible to prefabricate an easy to install tubing harness which is made up in much the same way as the familiar electrical harness.

Figure 4 shows the installation on a 1955 Lincoln car. The tubing has been colored so as to show up in the photograph but the actual installation is quite inconspicuous. This system was rigorously tested by the Lincoln-Mercury Division, Ford Motor Company, and adopted as optional equipment in 1955. The pumping unit is provided with a switch, Figure 2, which is closed by the plunger at the end of its stroke thus lighting a bulb on the Instrument Panel and signalling that the cycle is complete. The push button, Figure 5, operates a three-way valve connecting the vacuum diaphragm to intake manifold vacuum when pressed and vents to atmosphere when released after the signal light indicates the cycle is complete.

In conclusion I would say that the acknowledged advantages of centralized lubricating systems on industrial machinery are equally important for automotive equipment.

Author Carl H. Mueller is Vice-President in Charge of Engineering at Lincoln. Article was presented at SAE 1955 Summer Meeting.

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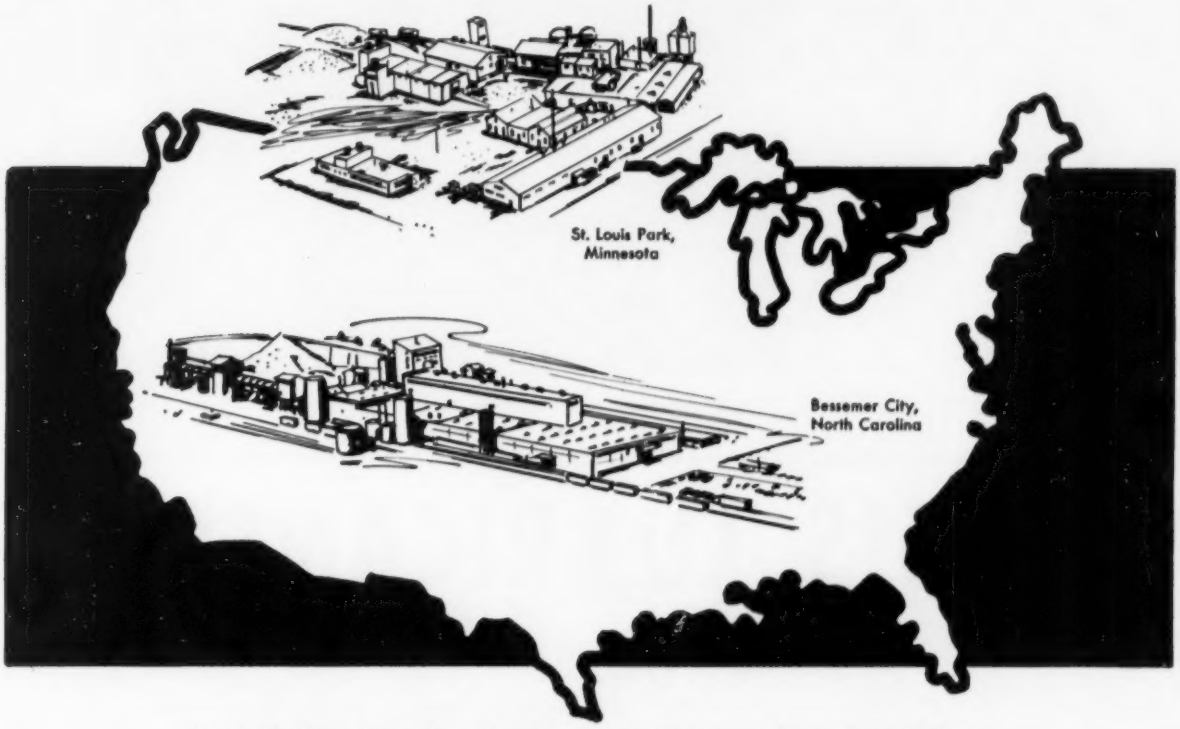

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Lithium Corporation's role in the grease industry is a many-sided one. Vast company controlled reserves of the raw lithium ore from which this key ingredient is derived assure the grease industry a source of supply for many years to come. Our $7,000,000.00 Bessemer City plant plus the company's original plant at St. Louis Park present a substantial increase in productive capacity. Stocks of lithium hydroxide are available from inventory at both plants. Immediate shipment can be made from the point nearest you. And company and industry sponsored research can bank on close cooperation from our management team. Since we are equally interested in developing better lithium products, why not get in touch with us? A card or letter will bring immediate response.

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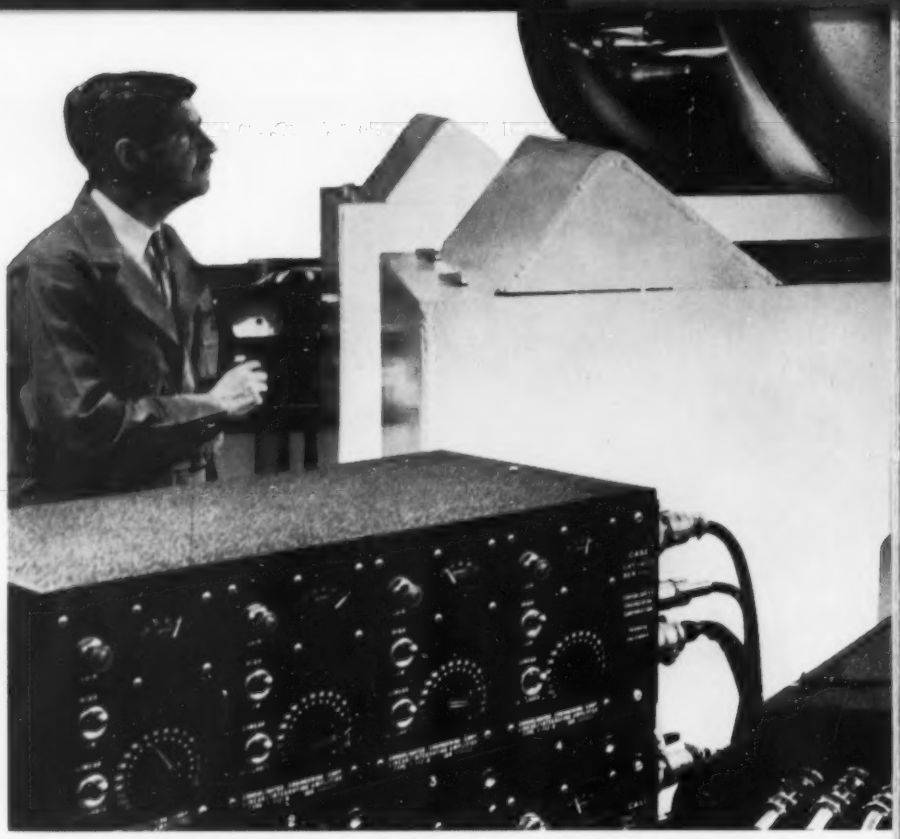
By L. J. KEHOE, JR.
General Motors Corp.
Detroit, Michigan



Author Kehoe tests rear suspensions in the laboratory.

A Critical Look at CHASSIS LUBRICANTS

Introduction in the early thirties of independent front suspensions, with the lower ride rates made possible, brought up forcibly a hitherto minor problem. At that time it became evident that the usual chassis lubricants were inadequate, so far as meeting the supposed greasing schedules set up.

It was not unusual for the greases of that day to be forced from the suspension parts in a 200 mile trip. Not realizing the inherent problem, some futile attempts were made to improve retention by mechanical means. Another moderately successful method used at times was to force water pump grease into the suspension bushings while violently agitating the car. After working on each fitting for about five minutes, a so-called grease job would be obtained which could at least prevent *squeaking* on a trip from Detroit to West Branch and return, approximately 400 miles, when the process could be repeated. Of course, king pins would not react favorably to this treatment. However, the most successful method was, and still is, to use "correction No. 1" which consists of walking away from the problem and pretending that it doesn't exist.

Now, some 25 years later, we are still faced with the same condition of short lived lubrication. So far as I know, there is no generally distributed grease capable of completely adequate lubrication of bushings, king pins, or metallic joints. On the rear of the car, in the past, we used threaded bushings which still have many advantageous features—such as lateral rigidity and (when properly lubricated) good life. We now use rubber bushings on the rear suspensions which while subject to several disadvantages—such as adding to the rate of the suspension, not as long life as a threaded shackle, and complications in obtaining sufficient lateral rigidity, still have one major advantage; a consistent pattern of performance. The rubber shackle and eye bushings, although somewhat less suited than a *perfectly lubricated* threaded bushing, present the very attractive feature of being installed and forgotten. Now, through the years, as we learn more of what makes our suspensions perform, we are continually returning to one feature, consistency. The rear suspension with rubber bushings and inner liners in the springs has that virtue. When we look at present front suspensions the same cannot be said. A keen observer, familiar

with a car's handling after a fresh lubrication, can pick out a change for the worse after ten miles of driving on a wet day or 100 miles on a dry day. The more average driver, familiar with the car, should be able to pick up the differences in 20 miles on a wet day and 200 miles on a dry day.

Power steering, instead of covering up these differences, probably accentuates them. In fact, it is becoming increasingly evident that some of the complaints laid at the door of power steering are actually lubrication faults. We in the Suspension Development Section have, in a small way, attempted to evaluate the performance of greases for suspensions. The difficulty in evaluating the worth of a lubricant lies in the fact that the value of a lubricant cannot be measured by when a suspension begins to squeak. Neither can it be measured, as I once thought, by a measurable increase in the static friction of the suspension. A year ago attempts were made to evaluate the suspension lubrication possibilities of some experimental greases. Pairs of automobiles in the same type of service were lubricated and the suspension ride rate friction measured. Each thousand miles a check was made of the stickiness of the suspension. Over a period of six to seven thousand miles without lubrication, there was no significant increase in suspension friction, but long before that the handling qualities of all the test cars depreciated considerably. We are at present trying some *experimental* greases which, although not yet as good as a suspension lubricant should be, seem to perform satisfactorily in dry weather for 800 to 1000 miles. The results obtained with these greases indicate, that with some development, lubricants could be compounded that could give consistent results for at least 2500 miles. It seems absurd that with automobiles easily capable of covering 500 miles in a day, that it should be necessary to grease a car twice a day for an observant driver and once a day for an average driver.

I, personally, do not feel that so-called automatic greasing systems are the answer. The added complications of a multiplicity of parts, susceptible to damage, in order to introduce a lubricant that was not adequate in 1935, does not strike me as being the answer. A superior lubricant introduced at less frequent intervals should be the goal. The oil industry has met the challenge of higher performing automobiles with higher performance gasolines, engine oils, transmission and differential lubricants. The next step should be a higher performance chassis lubricant: a development which is somewhat overdue.

This paper was presented at the SAE Summer Meeting at Atlantic City, June 1955

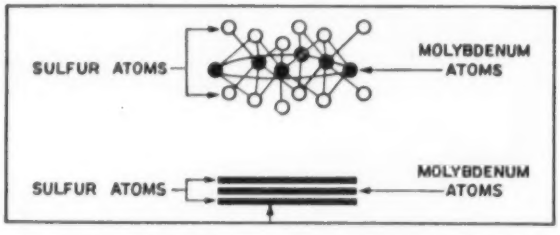
Effective lubrication of torsion suspension bushings of heavy duty trailers has been a maintenance problem with many truckers. The bushing at the left was removed still in good condition after 160,000 miles of service. This bushing was lubricated with a chassis grease containing Moly-Sulfide additive. The bushing at the right, lubricated with ordinary chassis grease, needed replacement after 35,000 miles of service.

How Moly-Sulfide additives EXTEND EFFECTIVE LUBRICATION

Why Moly-Sulfide additives are used in lubricants by trucking fleet operators, railroads, aircraft and automotive manufacturers, oil well drillers and steel mills.

Moly-Sulfide has six characteristics which make it an ideal lubricant additive wherever mechanical action wipes or shears off the hydrodynamic film.

1. Because of its affinity for metals, Moly-Sulfide readily forms a film on metal surfaces.
2. Moly-Sulfide has a low coefficient of friction.
3. It has a high factor of durability.
4. Moly-Sulfide has a thermal stability of −100°F. to +750°F.
5. It has a high chemical resistance to acids, alkalis and water.
6. It withstands high pressures, having a low shear strength and a high film strength.



Above, structural diagram of the Moly-Sulfide molecule. Below is a functional illustration of the laminar structure. Each lamina is composed of a layer of molybdenum atoms with a layer of sulfur atoms on each side.

What is Moly-Sulfide and how does it function in lubrication?

Mined in Colorado as molybdenite, purified Moly-Sulfide is a lead-grey material. It has a laminar molecular structure, with the Moly atoms sandwiched between layers of sulfur. (See illustration.) The sulfur atoms have an affinity for metal and

bond readily to metal surfaces, giving the film a *low shear strength*. This affinity is caused by a strong intermolecular bond between sulfur and metal. The lubrication results from the easy slippage of sulfur-to-sulfur atoms. As an additive to lubricants, the *Moly-Sulfide will readily form a film and when a grease or oil film is wiped away or sheared off, the Moly-Sulfide film sustains lubrication until a petroleum film reforms.*

Truck and passenger car builders and operators are making wide use of Moly-Sulfide greases for difficult lubrication jobs.

Lubricants containing Moly-Sulfide additive have over 30 established uses in the automotive, aircraft, railroad, oil drilling and steel industries.

Since Abraham Lincoln's time, railroads have been faced with a serious, recurring, *expensive* problem: hotboxes. Right now more than 14 million journal bearings are carrying heavy loads at high speeds on American railroads. These railroads have to deal with an average of 183,000 hotboxes a year at a cost of some $90,000,000.

Initial field tests by at least three leading railroads have shown hotboxes can be reduced materially by the use of grease containing Moly-Sulfide. A way has been devised to apply greases containing Moly-Sulfide on the journals of railroad equipment. This application is supplemental to the oil waste system and as a result the Moly-Sulfide films that are formed sustain lubrication until the oil film is reestablished.

American automobile and truck manufacturers and their customers are now using lubricants containing Moly-Sulfide additive in at least 14 different applications. These include chassis points, ball joint suspensions, torsion suspension assemblies, fifth wheels, shackle bolts, king pins, valve stems, automatic window mechanisms, wind-shield wiper mechanisms, seat adjusters, drive shaft splines.

In aircraft, Moly-Sulfide is added to aircraft greases. In jet engines under exacting conditions of temperature and pressure it is used on turbine shafts, splines and gear reduction units.

In other industries, Moly-Sulfide is being used in lubrication jobs which formerly presented serious difficulties. A Florida cement plant is using gear compound containing Moly-Sulfide to lubricate rack gears and a Michigan manufacturer uses Moly-Sulfide as an additive to drawing compounds for drawing stainless steel hub caps. In New York a baker of crackers and cookies is using Moly-Sulfide grease for lubrication of oven chains which must operate at high temperatures. In Louisiana an oil well drilling contractor is using Moly-Sulfide additive in tool joint compounds. He reports that disjointing when drilling below 15,000 feet is no problem now: no galling, welding or stripped threads.

Aircraft manufacturers are using Moly-Sulfide greases on many types of ball and joint suspension lubrication.

Oil well drilling contractors are using Moly-Sulfide additives to tool joint compounds.

Lubrication engineers are offered information and help in evaluating the use of Moly-Sulfide as an additive to lubricants by the Climax Molybdenum Co.

Currently Moly-Sulfide is being investigated by many petroleum research laboratories and lubricant users. They are interested in studying, under practical working conditions, the ability of Moly-Sulfide to increase effective lubrication.

If insuring effective lubrication is a problem facing your company, Moly-Sulfide additives may be a solution. Climax Molybdenum Company is the principal source of this product. If you need authoritative information, please get in touch with us and we will be pleased to send you literature on Moly-Sulfide and the sources of supply for experimental lubricants containing Moly-Sulfide.

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Please send me the following:

Literature
1. "Moly-Sulfide, Lubricant Additive" ☐
2. "Moly-Sulfide in Chassis Grease" ☐
3. "Moly-Sulfide Specification and Properties" ☐

List of Sources for
1. Railroad Greases ☐
2. Chassis Greases ☐

Sample — One-ounce tube of Moly-Sulfide ☐

Name .....

Position .....

Company .....

Address .....

CLIMAX MOLYBDENUM

Patents and Developments

Soap Grease Containing Alkaline Earth Metal Alkyl Phenol Sulfide

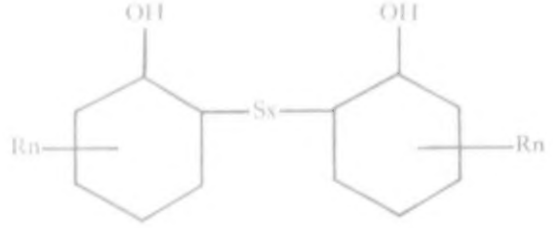
A grease inhibited against copper corrosion is disclosed in U. S. Patent 2,721,845 issued to The Texas Company.

While lithium base greases of the type covered in patent 2,450,221 are claimed to have proved eminently satisfactory in service, the increased use of copper and copper alloys in certain applications, particularly in aircraft and artillery control instruments, has introduced an additional problem of rendering the grease non-corrosive to copper in long time service. For this purpose, U. S. Army Specification 2-134 has prescribed a rigorous copper corrosion test for qualification under this specification. In attempting to meet this specification, it has been found that corrosion inhibitors heretofore employed in greases are ineffective.

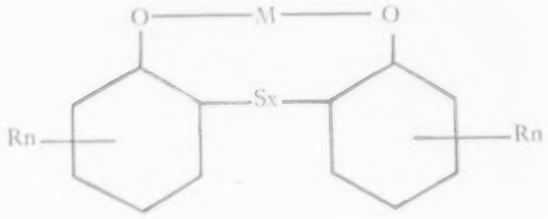
According to the recent patent, a grease is produced passing satisfactorily the aforesaid Army specification and retaining all the desired properties of the previously known greases of this type, including shear and texture stability over a wide temperature range and excellent low temperature properties, and at the same time is effectively inhibited against corrosion of copper and copper alloys in long time service.

In accordance with the present patent, the objects have been attained by incorporating in the grease about 0.25 to 5% by weight of an oil-soluble alkaline earth metal salt of an alkyl phenol sulfide having a total of 10 to 30 carbon atoms in the alkyl substituents on each benzene nucleus. Salts of this type have heretofore been suggested as detergent additives for mineral lubricating oils; but it was claimed to be entirely unexpected that such salts would function in the present greases as copper corrosion inhibitors, since this action is completely remote from detergency.

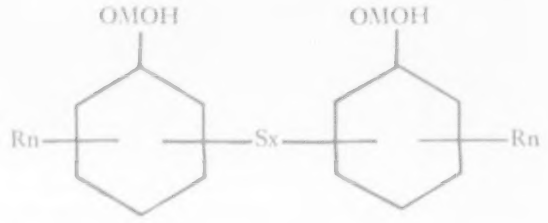
The alkaline earth metal salts which are effective copper corrosion inhibitors for purposes of the present invention, are prepared from the alkyl phenol sulfides having the structural formula



where R is an alkyl group containing 5 to 30 carbon atoms, *n* represents the number of alkyl substituents on each benzene nucleus and is generally 1 or 2, with the proviso that the total number of carbon atoms of the alkyl substituents on each benzene nucleus is at least 10, and *x* is either 1 or 2. The alkaline earth metal salts may be either normal salts wherein the alkaline earth metal completely neutralizes the OH groups of 2 molecules of the alkyl phenol, producing the compound having the formula



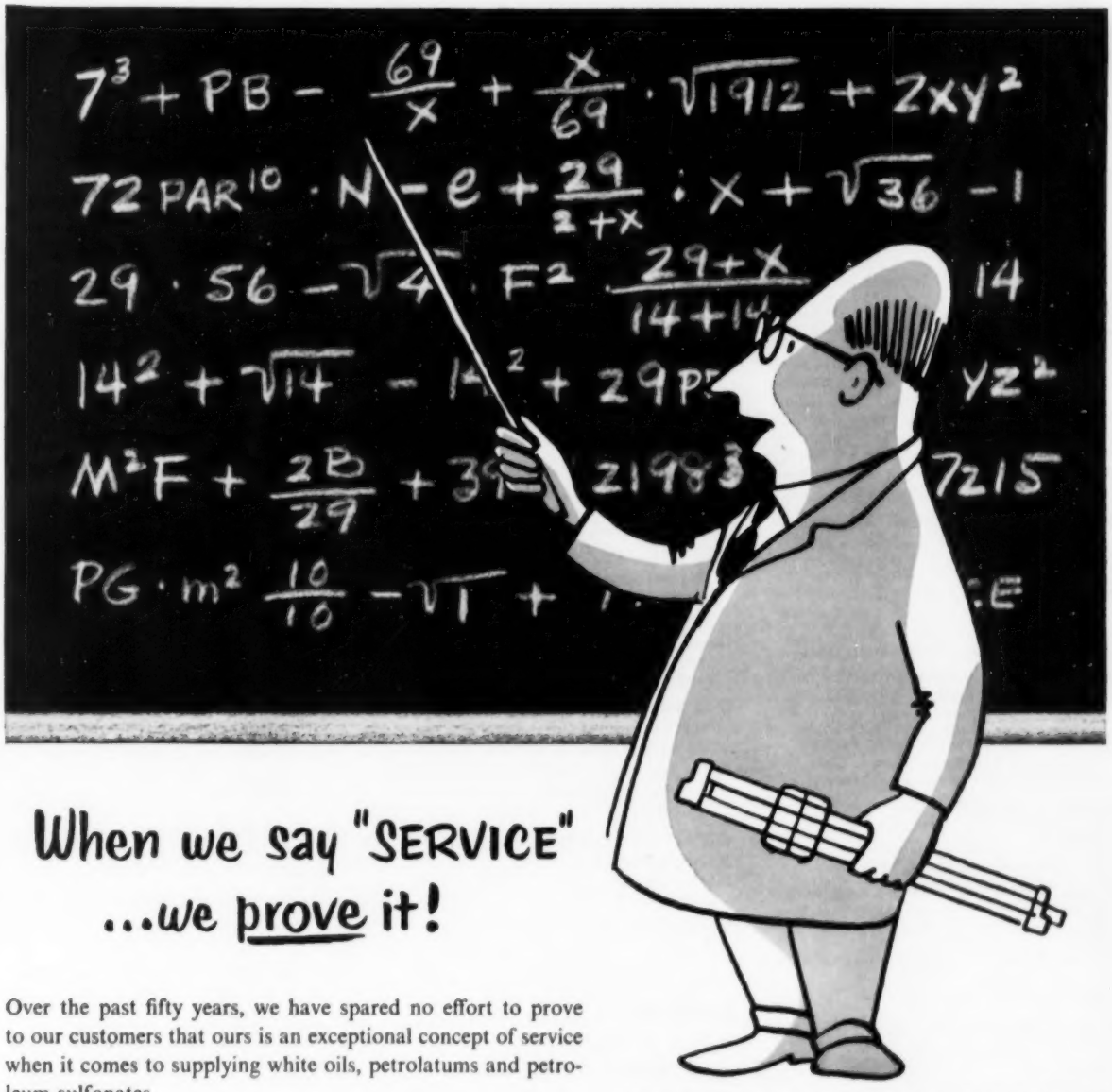
where M represents the alkaline earth metal, or may be the basic salt having the formula



These various compounds may be prepared in known manner by the alkylation of a phenol sulfide with a selected olefin or olefin polymer of the proper chain length, namely from 5 to 30 carbon atoms, in the presence of a suitable alkylation catalyst, such as HF, BF_3, and the like. The olefin polymer is preferably prepared by polymerizing propylene under pressure, using for example a $BF_3 \cdot H_2O$ catalyst. Likewise butylene polymer can be used. Depending upon the conditions of the alkylation, the phenol sulfide may be mono–or dialkylated. Where a lower molecular weight olefin, such as amylene is employed for alkylation, the phenol sulfide is dialkylated to provide a total of at least 10 carbon atoms in the substituent alkyl groups. Where a high molecular weight olefin is employed, such for example as a propylene polymer fraction having olefins of 15 to 30 carbon atoms in the molecule, the product is generally monoalkylated. In addition to simple phenol sulfide, other sulfides of monohydroxy mononuclear aromatic compounds having the hydroxyl group attached to the ring can be employed as the starting material, such for example as the cresols, xylenols and other alkyl phenols.

Typical compounds prepared as outlined above and which are useful for purposes of the present patent are barium diamyl phenolate monosulfide, barium diamyl phenolate disulfide, basic barium cardanolate sulfide formed from hydrogenated cardanol, magnesium alkyl

Continued on page 28



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phenolate monosulfide or disulfide wherein the alkyl group contains from 15 to 30 carbon atoms and is preferably C_{18} to C_{25}, and similar compounds of the other alkaline earth metals. Instead of preparing the alkyl phenol sulfide by alkylation as described above, suitable alkyl phenol sulfides containing at least 10 carbon atoms in the alkyl substituents on each benzene nucleus can be used, such as the hydrogenated cardanolate sulfide as specified above.

The above described alkaline earth metal salts of alkyl phenol sulfides may be employed in lithium base greases formed from any saturated fatty material, such as the conventional saturated fatty acids or glycerides thereof, to provide copper corrosion inhibition.

Preferably, the lithium base greases formed from hydroxy fatty acids or their corresponding glycerides, such as hydrogenated castor oil, are employed to obtain the improved shear and texture stability. Suitable types of soap-forming hydroxy fatty acids and glycerides thereof are disclosed in Patent No. 2,450,221.

A suitable barium diamyl phenolate sulfide is sold commercially by the Enjay Company, Inc., as "Paranox 56". Inhibitors of the type disclosed in Patent No. 2,610,946 are claimed to be completely ineffective for this purpose.

Synthetic Lubricating Oils Containing Paraffinic Resins

In the lubrication of jet engine bearings which operate at very high temperatures the prior art greases have hitherto been lacking in some instances. In attempts to prepare greases, having the requisite high melting points and having a soap-dispersing fluid with requisite high flash point, grease formulations have been made from synthetic lubricating oils of the diester type exemplified by di-2-ethyl hexyl sebacate. However, they have generally proven unsatisfactory for this high temperature use due to low dropping points and too high volatility. Attempts to prepare greases by thickening the complex estertype synthetic oils, such as a synthetic oil prepared by reacting two molar proportions of a half ester of a dibasic acid with one molar proportion of a glycol, have been generally unsuccessful.

U. S. Patent 2,723,957, issued to Esso Research and Engineering Company, describes lubricating greases having the desirable high temperature characteristics obtained by blending with a synthetic oil of the diester or complex ester type a high molecular weight resin, and thickening the blend with a lithium soap of a high molecular weight fatty acid.

The preferred esters may be esters of succinic, adipic, pimelic, suberic, or similar acids, or they may be complex esters such as those prepared by reacting together two moles of a mono 2-ethyl hexanol ester of sebacic acid with one mol of a polyethylene glycol.

The resin is a propane-precipitated material. It is well known in the art that paraffinic crude residuums especially the Pennsylvania crude residues, may be dissolved in an excess of liquid propane or other very light hydrocarbons under pressure at ordinary temperatures. The procedure generally is to use at first about two volumes of liquid propane for each volume of residuum, the solution thereafter being cooled by allowing some of the propane to evaporate. Such cooling may cause a separation of some of the wax which may be removed. Upon addition of further propane, up to about 10 volumes per volume of residuum, and mild heating under pressure, a viscous resinous product of relatively low volatility and of high molecular weight is precipitated in the form of a heavy oil to a plastic solid material. This resinous material has a viscosity in excess of about 300 SUS at 210°F. and a flash point in excess of 500°F. The material, per se, is well known in the prior art. It is substantially neutral, being essentially free from acids, though its exact composition is unknown. These propane precipitated resinous materials are blended with the synthetic oils mentioned above to form the base oil for the grease compositions of the instant invention.

Blending the resinous material with the synthetic oil accomplishes several objects.

1. It improves the high temperature properties of the grease to a point at which the composition has utility for jet engine bearing lubrication.

2. It lowers the volatility of the dispersing medium. A low volatility of the dispersing fluid in these high temperature greases is mandatory. Flashing off the liquid portion of the grease would result in heavy soap concentrations which would char or polymerize, resulting in frozen bearings.

3. It raises the viscosity of the synthetic oils which are somewhat low in viscosity in the extreme temperature range.

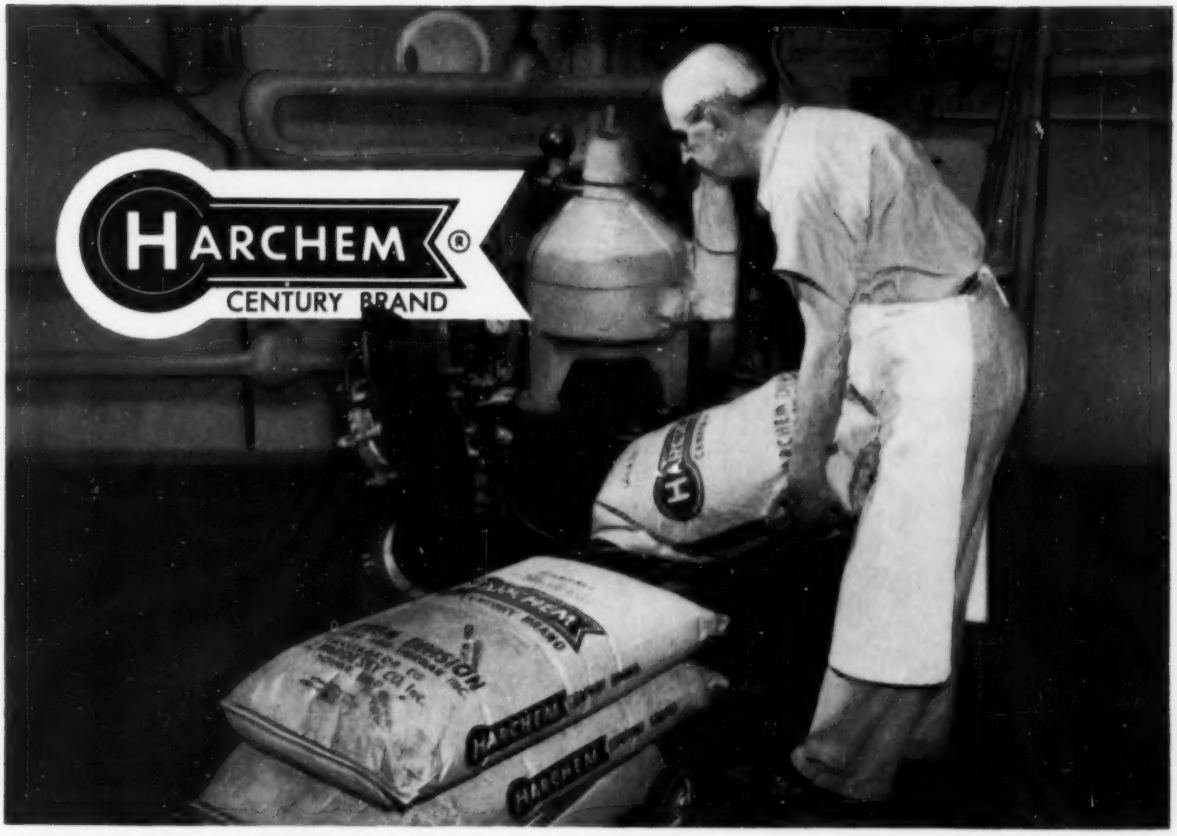
4. It replaces the expensive synthetic oil with a material having a decided lower cost, resulting in an obvious economic advantage.

To form the lubricating oil base for the improved high temperature greases of this patent it is contemplated that a blend containing from about 20% to 50% by volume of the resin to about 80% to 50% of the synthetic oil chosen be used. Various factors will affect the component proportions used, of course, such as the type of synthetic oil used, the viscosity of the resin, the temperature at which the grease composition is to be used and the like. It is generally preferred, however, to blend with a synthetic lubricating oil of the ester type about 25% to 35% by volume of a resin having a viscosity in excess of about 300 SUS at 210°F.

The amount of soap that is used to thicken the blend into a finished grease formulation will also vary according to the desired product. Generally, it has been found advantageous to thicken the blends with from 10% to 25% by weight of the soap, with from 15% to 20% of the soap being preferred.

The procedure used in formulating the grease compositions of this invention is straightforward and presents no problems to those familiar with the art. Generally it is as follows:

The resin and the preformed soap are stirred together in a fire heated grease kettle and heated to a temperature of about 150°-300°F. The synthetic oil is then added and the mixture stirred and heated to a temperature of about 400°-430°F. is reached. The grease is then drawn into shallow pans and allowed to cool. After cooling it is homogenized by working. If desirable, inhibitors or other improving additions may be added to the grease



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after heat has been removed and before drawing.

If it is desired to form the soap in situ this may be done by adding the fatty acid to the kettle followed by the lithium, usually in the form of the hydroxide while only the resin is present. After complete neutralization and dehydration of the soap the complex ester is then added. By this method any hydrolysis of the ester is materially prevented.

An example of a grease prepared in accordance with this patent is as follows:

7.5% lithium hydroxy stearate.
7.5% lithium stearate.
1.0% oxidation inhibitor.
24.0% resin (vis. 210°F./444 SUS).
60.0% complex ester.

The lithium soaps were mixed in the resin and dispersed at 350°F., when the complex ester was added and the mass heated while stirring to 420°F.; the inhibitor was added and the grease cooled in shallow trays.

ASTM inspections:

Penetration (mm./10)—	
Unworked	265
Worked (60 strokes)	267
Worked (100,000 strokes)	295
Dropping point (°F.)	395
Aeration (same condition as Example 1 60 minutes in a grease beater)	5%
Percent evaporation at 350°F.—24 hours	1.0

Aluminum Soap Fracturing Compositions

Occasionally, there are mentioned in this column, oil thickened compositions employed for purposes other than for lubrication, with the purpose of possibly pointing up new properties which could be advantageously applied to lubricating grease uses. Recently, U. S. Patent 2,724,439 was issued to Stanolind Oil and Gas Company on a thickened composition for fracturing oil formations.

In this patent, it is pointed out that fracturing of such type (Hydrafrac) was first covered in the Harris patent 2,596,843. Gels suitable for the purposes are disclosed in the Clark patent 2,596,844. The recent patent, however, is an improvement involving incorporating another agent in the composition. The new improvement involves adding 0.1-0.5 part of furfuryl alcohol to the 100 parts light hydrocarbon, 1 part of water and 3-6 parts of napalm soap. This is said to give a superior gelation rate after a 10 minute initial period after introduction of the gel into the well, which eliminates the need of pumping a very viscous material.

Greases Containing an Anti-Rust

Rusting of steel parts is often encountered where greases are used as the lubricant. Moisture deposited on the grease is transferred to the lubricated steel surface by the conjoint action of the soap and the moving part. The soap acts in the role of emulsifier for the water which is brought into emulsion with the lubricating fluid and subsequently moved to the steel surface through the continual working of the grease by the moving part. Corrosion by rusting also may occur in the case of iron-bearing parts packed with grease for storage or shipment where the grease film, either initially or through accidental rubbing off, is quite thin. In such case, moisture, such as rain, or condensate from atmosphere, can penetrate through the thin grease film to cause rusting of the iron bearing surface.

According to U. S. Patent 2,722,512, issued to Robert L. Merker, greases having anti-rust properties can be obtained by providing in the grease a water-soluble salt of an alkyl monocarboxylic acid of 6 to 10 carbon atoms or of an alkylene dicarboxylic acid of 7 to 20 carbon atoms. The hydrocarbon group of the acids may be branched or unbranched. The water-soluble salt is the neutral salt of the dicarboxylic acids. Suitable carboxylic acids for forming the acid portion of the salts are, for example, hexanoic, heptanoic, octanoic, 2-nonanoic and decanoic acid of the monocarboxylic series and pimelic, suberic, teramethyl succinic, azelaic, heptyl malonic butyl adipic, sebacic, dodecanedioic, tera-decanedioic and hexadecanedioic acid of the dicarboxylic series. A preferred group of acids for the salts are the dicarboxylic acids having from 8 to 10 carbon atoms, e.g., suberic, azelaic and sebacic acids. The salt-forming group of the water-soluble salts may be taken, for example, from the alkali metals, the alkaline earth metals, ammonium, and water-soluble amines. The sodium salts constitute a preferred group of the water-soluble salts of the afore-defined classes of carboxylic acids for preparing the improved greases.

These antirust salts are not soluble in greases or the soap used for thickening the same, and accordingly, are dispersed therein by some suitable means, as, for example, by milling the grease with the salt in finely divided form on a three roll mill. The amount of the salt added may be varied somewhat depending upon the degree of rust prevention desired and the activity of the particular salt selected. In general it will be found that between about .05% and about 0.2% by weight of the salt on the grease will be found sufficient to give complete protection against rusting of iron-bearing surfaces lubricated with the greases. Instead of adding the salt to the grease, it may be incorporated in the soap which is then used for thickening of the lubricating fluid to form the grease.

The water-soluble salts function in the grease as anti-rusts by dissolving in the water at the metal surface to form a layer thereon constituting a barrier between the metal and the water.

The invention is further illustrated by the results appearing in the table below and obtained from comparative corrosion tests in which a series of water-soluble salts were employed including certain of the above defined carboxylic acid salts. The tests were performed by immersion of a clean, cold rolled steel strip (1½"x¾") in a water (tap) solution of the salt for the stated periods of time at a temperature of 80°C. The pH of all the salt solutions was approximately 8.

Under the same conditions and using as inhibitor, respectively, potassium, lithium, calcium, barium, strontium, magnesium, methyl and isopropyl amine azelates (neutral salts) in a concentration of slightly less than 0.2% by weight, no rusting of the steel strip was observed even after a period of 100 hours immersion in the aqueous solution of the salt.

The rust inhibitors of the present patent can be used in a wide variety of greases both from the standpoint

of the lubricating fluid and the soap used as thickener. The most common greases are those in which a petroleum oil is thickened with sodium or calcium stearate. However, the inhibitors may not only be used effectively in these common greases but likewise in greases in which the lubricating fluid is of synthetic origin, such as the diesters (alkyl esters of alkylene dicarboxylic acids), silicones, and polyalkylene oxide fluids, e.g., polyiso-propylene oxide, which have been stoppered at both ends with an alkyl group, e.g., butyl, and the thickener is a metal soap of other, limitedly water-soluble higher fatty acids, e.g., lithium palmitate, aluminum stearate, etc.

TABLE

Salt	*Per Cent Weight of Salt*	*Appearance of Metal Specimen After—* 3 *hours*	24 *hours*	100 *hours*	1,000 *hours*
Sod. benzoate	0.2	bad rust	.....	.....	
Sod. phenolate	0.2	bad rust	.....	.....	
Sod. acetate	0.2	bad rust	.....	.....	
Sod. laurate	0.2	slight rust	much rust	.....	
Sod. stearate	0.2	very slight rust	slight rust	.....	
Sod. hexanoate	0.2	no rust	no rust	no rust	no rust
Sod. heptanoate	0.2	no rust	no rust	no rust	no rust
Sod. 2-nonanoate	0.2	no rust	no rust	no rust	no rust
Sod. oxalate	0.2	bad rust	.....	.....	
Sod. malonate	0.2	bad rust	.....	.....	
Sod. succinate	0.2	bad rust	.....	.....	
Sod. adipate	0.2	bad rust	.....	.....	
Sod. suberate	0.2	no rust	no rust	no rust	no rust
Sod. azelate	0.2	no rust	no rust	no rust	no rust
Sod. sebacate	0.2	no rust	no rust	no rust	no rust
Borax	0.2	slight rust	much rust	.....	

N. B. Test discontinued in runs where positive evidence of rusting. The sodium salt of the indicated dicarboxylic acid is the neutral salt in each case.

News Items

New rust-preventive greases are advertised by Sun Oil Company, Philadelphia, as being specially fortified to protect against wet operating conditions and give improved lubrication. Effective life is claimed to be about twice that of conventional greases operating under wet conditions (Auto. Indus. 11/1/55, p. 107).

The Rockwell-Nordstrom 860 experimental valve lubricant for use specifically on hydrocarbon gases from -75°F. to 130°F. is being tested by Rockwell Mfg. Co., under simulated field conditions. It is said to be especially suited for large valves on natural gas lines at 1000 psi (The Flow Line 10/55, p. 8).

Partially fluorinated esters and ethers are being proposed as lubricant bases (OTS Rept PB 111684, Dept. of Commerce).

New organo-silicone compounds (X-520-2 and 5-7) are being produced by Linde Air Products Co. and are claimed to possess many properties hitherto not available in silicones for lubrication, etc. (Technical Survey 11/26/55, p. 812).

According to Check-Chart Corp., Chicago, the 1955 market potential for auto chassis lubricants was 41% higher than in 1941 and, in 1965, it will be 26% higher than in 1955, assuming no great trend to increased service interval between lubrications (J. Commerce, 11/22/55, p. 13).

Gear lubrication: Fundamentals and problems, standard specs, use of EP agents, solid additives and synthetic lubricants, emphasizing lubrication of higher capacity gearing and unusual operating conditions—Kyropoulos (Mach. Des. 11/55, p. 156).

A new mixed Texaco soap-solid thickened synthetic oil grease is claimed to lubricate satisfactorily ball bearings from -65°F. to 450°F. It contains a non-silicone type oil—Dilworth et al (Oil & Gas J. 12/12/55, p. 103).

U. S. Patent 2,726,790 (Balcrank, Inc.)—Grease supply system.

Water Resistant Soda Base Grease Containing Siliconate

Soda soap base greases have one serious deficiency in that they are quite subject to water leaching or to structural breakdown and other types of deterioration in presence of liquid water or other moisture. Moreover, known materials used for water-proofing in general are not effective. According to U. S. patent 2,731,417, issued to Esso Research and Engineering Company, this deficiency is due primarily to the fact that most soda soaps of conventional fatty acids are highly water-soluble. When greases containing such soaps come into contact with substantial quantities of water or moisture the soap is gradually leached out of the grease. Eventually the oil is left without an effective thickener. The oil runs out of the bearing or away from other mechanical parts to be lubricated, leaving them unprotected. Lubrication failure results in many cases.

Another deficiency of soda soap greases, and most other lubricating greases, is their tendency to oxidize in the presence of air. The lubricating oils in the grease themselves deteriorate in the presence of air, especially under prolonged high temperature conditions, and the soaps also are degraded per se. Eventually the greases become crusted and hard and lose their lubricating value.

According to the aforesaid patent, it has been discovered that soda base greases in particular and other greases containing soda or other water soluble soaps in general can be improved in both their water sensitivity and in their oxidation resistance by adding thereto relatively small proportions of alkali metal siliconates. Siliconate proportions from as little as 0.1 to as much as 10% by weight, based on the weight of the total grease composition, may be used. The preferred range is between 0.5 and 5% of siliconate.

A particularly useful type of siliconate is one sold commercially by the General Electric Company as "SC-50."

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J&L STEEL

Jones & Laughlin
STEEL CORPORATION — *Pittsburgh*
CONTAINER DIVISION
405 Lexington Ave., New York 17, New York

This product is an alkaline salt, ordinarily sold in aqueous solution, containing minor proportions of basic salts such as Na_2O and a major proportion of silicon-containing salts such as sodium methyl siliconate, the siliconate radical being understood to have the approximate average formula $CH_3SiO_{1.5}$. This material as sold commercially has a specific gravity of about 1.23 and a pH value of about 13.

These siliconates may be prepared from basic chlorosilanes by treatment with alkali according to known methods. The greases to which they are added are prepared preferably by forming a combination of the siliconate salt with the ordinary soap, e.g. sodium soap of C_{12} to C_{24} fatty acids, used for thickening the grease. This combination is then dispersed in a suitable lubricating oil. The resulting grease product has not only a much greater water resistance than conventional soda soap greases but its oxidation resistance likewise is improved very appreciably. The use of a single modifier to accomplish these results is very advantageous.

Inasmuch as the siliconate has a high degree of alkalinity (pH of about 13) it can be used as part or all of the saponifying agent in the preparation of soap from fatty acids, if desired. In dilute solutions sodium methyl siliconate appears to exist largely or approximately in the minomeric form $CH_3Si(OH)_2ONa$. When dried it loses water and forms a polymer of approximate formula (CH_3SiO_2Na).

In concentrated solutions many different polymers probably exist such as the dimer and other low polymers. By adding additional alkali (NaOH) to such solutions polybasic compounds of the ortho acid may be formed such as $CH_3Si(ONa)_3$. When these sodium salts are used to saponify fatty acids, the alkali is neutralized. A more general formula for these salts is $CH_3SiO_xM_y$ where x and y are integers of 1 to about 5 and M is an alkali metal.

Methyl siliconic acid, $CH_3Si(OH)_3$, is liberated when acids are added to aqueous solutions of the sodium salts described above. Even very weak acids, such as the carbon dioxide present in the atmosphere, can bring about this reaction. The free methyl siliconic acid is insoluble in water and precipitates out in situ on the soap that is formed. This appears to be the actual basis for the waterproofing action of sodium methyl siliconate in soda base greases and the like. At room temperatures the curing process necessary to effect waterproofing in the air, using no other curing medium, requires about 24 hours. At elevated temperatures such as 300°F. or so, which is a common grease cooking range, a time of 15 to 60 seconds is sufficient.

The invention may be shown more clearly by reference to results obtained with several experimental sodium base greases of the formulas shown in the table below. These were compared with a conventional commercial sodium stearate grease designated A. Grease B was prepared by

adding an aqueous solution containing 1.5% by weight, based on the treated grease, of sodium methyl siliconate (General Electric SC-50) to the soap. Thereafter the soap-salt combination was dehydrated at 300°F. The dehydrated soap combination was prepared by cooking in a small quantity of mineral base lubricating oil. Later the soap concentrate thus formed was cut back to the desired consistency with further quantities of mineral base lubricating oil.

In grease C a much larger amount, 10%, on a dry basis, of sodium methyl siliconate was incorporated in the grease, omitting sodium hydroxide altogether. The alkali of the siliconate served as the entire saponifying ingredient for converting the fatty acids to soap.

It will be observed in the table below that the water resistance of the new greases B and C was very good for a short period of time even at temperatures as high as the boiling point of water. Ordinary soda soap greases are somewhat water resistant up to about 125°F., this figure applying to sodium stearate greases. As far as is known, no prior art soda soap grease has been prepared hitherto with an appreciable water resistance above this temperature. In fact it is very difficult to water-proof a soda base grease. Addition of alkyd resins, for example, which are effective water-proofing materials for certain other types of greases which are moisture sensitive, are totally ineffective in soda base greases.

The extraordinary leaching resistance of greases B and C shown in the table below at 150°F. is considered remarkable. This probably simulates conditions actually encountered in lubricating service, for example, in electric motors, automobile wheel bearings, and the like. It will be noted that in a special test at 150°F., running a ball bearing wet for one hour, at 600 R.P.M. the new greases lost only 2 to 5% of their weight due to leaching. The conventional prior art soda soap grease lost over 99%.

It may be noted, as indicated above, that the oxidation resistance was very markedly improved. A grease hardening test, which is a good measure of oxidation, was devised so that a micropenetration or hardness measurement of 5 was established as the limit of useful grease life in a 300°F. oxidation test. Grease A, a conventional anti-friction bearing grease without the siliconate, showed a life in this test of only 290 hours at 300°F. Grease B showed a life of 810 hours at the same temperature.

Another grease, containing 20% sodium stearate in a lubricating oil of 500 S.S.U. viscosity, which may be considered essentially a "blank" for grease B, showed a test life of only 300 hours. When 1% of one of the best known conventional oxidation inhibitors, phenyl alpha naphthylamine, was added the oxidation life became 690 hours. The latter, of course, has no water-proofing value.

While most greases utilize mineral base oils of between about 100 and 2000 S.S.U. viscosity, and viscosity index between 40 and 100 or so, special purpose lubricants may include more viscous oils and/or oils of higher viscosity

indexes. Also, synthetic oils may be used in whole or in part, as will be readily understood by those skilled in the art. Thus, synthetic esters, glycols, polyglycols and related ethers, acetals, and the like may be used to replace part or all of the mineral base oil constituent. It should be kept in mind, however, that saponification reactions with strong bases usually cannot be carried out in these synthetic oils, especially the esters, without hydrolysis or other degradation. Hence, it is usually preferred to perform the saponification step in the presence of mineral oil if the soaps are to be formed in situ. The fatty acids used for the soap may include substituted acids such as hydroxy stearic acid, keto acids, etc.

Obviously, conventional modifiers such as metal deactivators, corrosion inhibitors, tackiness agents, viscosity index improvers and supplementary corrosion inhibitors may be used in conventional proportions.

TABLE 1

Formulae and Inspection of Sodium Soap Greases

	A	B	C
Formula, percent by Wt.:			
Stearic Acid	17.0	21.5	30.0
Sodium Hydroxide (dry basis)	3.1	4.0	
Sodium Methyl Siliconate (dry basis)		1.5	10.0
Mineral Oil,[1] V./100 SUS=675, V. I.=80		73.0	
Mineral Oil,[2] V./100 SUS=320, V. I.=55	79.9		60.0
Inspections:			
Free Alkali, percent	0.15	0.06	0.02
Micropenetration	95	70	80
ASTM Wkd. penetration (calc.)	295	260	275
Water Resistance Tests, 3 GP-O, Method 9.2.[3]	water turns cloudy; grease disintegrates giving some free oil.	water turns cloudy; does not disintegrate.	no cloudiness in water.
"Leaching Resistance"—VVL-791D, Amendment 1, Method 325.2[4]:			
At 125° F., Grease Loss, percent		1	
At 150° F., Grease Loss, percent	99.3	5	2

[1] Phenol treated Tia Juana distillate.

[2] Acid and clay treated Tia Juana distillate.

[3] Method designed to test tendency of grease to emulsify when in contact with water; 0.5-1 fim. greases on the end of a stirring rod is immersed in 200 cc. boiling water for ten seconds.

[4] 3 gm. grease is packed into 204K type ball bearing which is rotated at 600 R. P. M. Water is pumped through a 1 mm. capillary tube at 5 cc./sec. and impinges on the end plate of the bearing ⅛ inch above the outer opening of the bearing housing. The duration of test is one hour. The temperature specified usually is 120° F. These tests, however, were carried out at higher temperatures as indicated.

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for all applications involving high load, high speed, water hazard and wide temperature variations

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THE Burlington plant contains many giant presses, heavy production equipment and hundreds of secondary tools. All of this equipment is lubricated with a single multi-purpose grease . . . Shell Alvania.

Shell Alvania Grease is bringing outstanding machine protection and lubrication economy to plants from coast to coast. It is a true multi-purpose grease . . . shows remarkable indifference to heat, cold, water and machine speeds. In plant after plant, Shell Alvania Grease serves *every grease application* in the production setup!

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1. **Shell Alvania Grease flows *freely* in cold temperatures, yet will not run out of bearings under excessive heat.**
2. **Ideal for wet, humid applications . . . it resists water emulsification.**
3. **Shell Alvania Grease has extremely high oxidation stability.**
4. **You'll find that Shell Alvania Grease extends time between greasings . . . a substantial saving in labor and grease.**
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Technical Committee

Chairman T. G. Roehner, Director of the Technical Service Department, Socony-Mobil Laboratories

Nick Marusov of Gulf Research & Development Company has resigned as Chairman of the NLGI Subcommittee on Delivery Characteristics of Dispensing Equipment for Lubricating Greases because he has had a change of position within his company and he will no longer be active on lubricating grease projects. Gus Kaufman of The Texas Company has agreed to be the new Chairman. One of the important current responsibilities of this committee is to stimulate the adoption of the NLGI Dispensing Method by dispensing equipment and grease manufacturers as well as by consumers. Gus Kaufman is particularly well qualified to promote such a program because he is one of the original members and is familiar with the objectives of this cooperative activity.

The present membership of the NLGI Editorial Review Subcommittee is the following:

George Entwistle, Sinclair Refining Company, Chairman
P. R. McCarthy, Gulf Research & Development Company
J. E. McGrogan, The Atlantic Refining Company
J. Musselman, Standard Oil Company (Ohio)

A decided majority of the replies to the questionnaire distributed with our covering letter of January 15, 1956, were in favor of holding another session along lines similar to those of the 1955 Panel Discussion on Lubricating Greases for Modern Farm Machinery. In respect to the selection of the subject, the replies showed a strong trend in favor of Lubrication of Ball Bearings. Hollis Leland of Esso Research and Engineering Company has accepted the assignment of Chairman of the Panel Committee to organize and conduct the session. He will welcome suggestions regarding selection of kick-off speakers and like important details on which the success of the discussion is so dependent. His address is:

Dr. H. L. Leland
Esso Research & Engineering Co.
P. O. Box 51
Linden, New Jersey

The questionnaire also provided for recording of comments concerning the advisability of again holding a Symposium on a so-called "Basic Study." The replies received to date show a majority voting "yes." However, organization of a committee to handle the session is being postponed until additional replies can be tabulated because a clear-cut preference has not yet been indicated for any specific subject.

PEOPLE in the Industry

B. H. DANZIGER

J. J. MIKITA

Danziger Appointed Climax Advertising Manager

Benjamin H. Danziger has been appointed manager—advertising and promotion of Climax Molybdenum Company, it has been announced by Reuel E. Warriner, vice president—sales. He was formerly manager—catalyst and pigment development.

Mr. Danziger, who is assuming his new duties immediately, joined Climax in 1952 as assistant budget officer. In 1954, he was assigned to the chemical market development position he held until his present promotion.

Mr. Danziger's other industrial experience includes three years with the Ruberoid Company as a research and development engineer and production supervisor.

A 1948 chemical engineering graduate of Massachusetts Institute of Technology, Mr. Danziger also studied Industrial Management at Rutgers University and earned an M.B.A. degree in 1952 from Harvard University Graduate School of Business Administration.

Mikita to Manage Du Pont's Additives Division

Du Pont's Petroleum Chemicals Division has established a new additives sales group to improve customer service and to prepare for new petroleum additives developments, David H. Conklin, director of sales.

J. J. Mikita, formerly director of Du Pont's Petroleum Laboratory, has been named sales manager of the new additives group with headquarters in Wilmington. His assistant will be W. W. Wingate, formerly in the product development group of the Petrodeum Chemicals Division.

W. E. Bettoney, formerly an assistant director of the Petroleum Laboratory, will become manager for additives in the Eastern region with headquarters in New York. N. D. Lawson, who has been head of the fuels and lubricants section of the laboratory, will take over as manager for additives in the Central region, working out of Chicago. J. B. Malin has been named to the new position in the Western region where he has been regional laboratory manager.

Dr. B. M. Sturgis, formerly assistant director, has been promoted to director of the Petroleum Laboratory. Assistant laboratory directors will be R. O. Bender, in charge of technical service, and R. H. Blaker, handling product evaluation.

E. F. Houghton Co. Elects Frank Ross to Board

Frank Ross was elected to the Board of Directors of E. F. Houghton & Co. at that company's annual stockholders' meeting.

Mr. Ross is Assistant to the Vice-President—Sales at Houghton, manufacturers of industrial oils, chemicals and packings located at 303 West Lehigh Avenue, Philadelphia.

He joined Houghton in 1942 as Manager, Lubrication Sales. In July, 1949, he was named Assistant to the Vice-President—Sales. He was formerly Sales Manager for the Lubrizol Corporation and previously on the sales staff of the Texas Company.

Officers re-elected at the meeting include A. E. Carpenter, Chairman of the Board, and William F. MacDonald, President.

Board members re-elected were A. E. Carpenter, William F. MacDonald, D. J. Richards, Dr. J. T. Eaton, Mrs. A. E. Carpenter, J. F. Maisch, C. H. Butler, H. B. Fox and D. C. Miner.

Mr. Ross lives at 1458 Jericho Road, Abington, Pa., with his wife, Margaret They have two sons, Frank, 25, and John, 18. He is an active member of the American Society of Lubrication Engineers, Society of Automotive Engineers, LuLu Temple Shrine and the LuLu Temple Country Club.

G. J. FAHEY

E. A. LAMPMAN

Fahey Named Sales Representative for Vulcan

Gerald J. Fahey has been named Sales Representative for Vulcan Containers, Inc., leading manufacturers of Steel Shipping Drums and Pails, by Herbert B. Scharbach, Vice President.

Mr. Fahey will represent Vulcan in the Greater Detroit area contacting manufacturers of paint, chemicals, adhesives, printing inks, food and petroleum products.

Prior to establishing himself as a manufacturers' representative, Mr. Fahey was Purchasing Agent for the Detroit Adhesives and Coatings Division of the Minnesota Mining and Manufacturing Company, a position he had held since 1944.

Acheson Colloids Announces Retirement of Edwin Lampman at Age of 70

Some men attribute longevity to temperance or to intemperance, to wild living or to quiet living. But Edwin A. Lampman, who retired on January 3, 1956, from Acheson Colloids Company, Port Huron, Mich., after many years as a service engineer, has a different reason—colloidal graphite. Still very active at the age of 70, Mr. Lampman says, "I use 'Oildag' every thousand miles and see my garage mechanic twice a year." He strongly urges others to adopt this formula.

Born December 18, 1885, in Maryland, N. Y., he started working for the Acheson Graphite Company about 40 years ago, covering the Ohio market. After 7½ years there, he joined the old Vaccum Oil Co., later proceeding to Marland Oil (now Continental Oil) and Cities Service Oil Co. In 1940 he joined Acheson Colloids Corporation, as the Company was then known, and was in charge of the Pittsburgh office for twelve years. Three years ago, he opened the Rochester, N. Y., office, and has since covered Western New York for Acheson.

Mr. Lampman is a member of the American Society of Lubrication Engineers. He and Mrs. Lampman live at 424 Cedarwood Terrace, Rochester, N. Y.

M. W. Dischert Appointed Shell Real Estate Manager

Shell Oil Company announces the appointment of M. W. Dischert as manager of the real estate and development department, effective March 1. He succeeds T. S. Johnston, who is retiring after 33 years of service with the company.

E. R. Botter, real estate representative in New Orleans, and R. H. Hahn, sales supervisor in Akron, have been appointed assistants to the manager. Mr. Botter will be assigned to the department work of the Midwest sales area and will act as deputy in Mr. Dischert's absence. Mr. Hahn's assignment will cover the East Coast sales area.

Mr. Dischert joined Shell in 1923 as a stock clerk in St. Louis. He later served in various capacities in Atlanta, Georgia, Jacksonville, Florida, New Orleans and Chicago. Last August, he was promoted to the post of assistant manager, real estate and development department in New York.

Mr. Botter started as a salesman at Kilgore, Texas, in 1937. In 1944, following a miltary leave of absence, he became a driver salesman in Houston. In 1949, he was named district sales supervisor there and in 1953, became New Orleans real estate representative.

Mr. Hahn joined Shell as a clerk in St. Louis in 1948. He subsequently served as district representative in the marketing department at Wood River, Illinois, Decatur, Illinois, Memphis, Tenn., and Cleveland, Ohio. In 1954, he was named sales supervisor of the Akron District.

Cooper Joins American Potash & Chemical Corp.

Dr. Hal B. H. Cooper has joined American Potash & Chemical Corporation in the newly-created position of director of Development Engineering, according to an announcement by Dan

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36 Years of Growth

S. Dinsmoor, vice president in charge of Research and Development.

Cooper will be in charge of special engineering phases of new projects and developments at various company plants and will act as engineering advisor on pilot plant research operations.

Cooper, who will headquarter at American Potash & Chemical Corporation's main offices at Los Angeles, previously was assistant director in charge of Development for Colgate-Palmolive Company. He graduated from Iowa State University in 1936 with a bachelor of science degree in chemical engineering, obtaining his Master's degree in chemical engineering at Massachusetts Institute of Technology in 1938 and his Ph.D. in chemical engineering at Iowa State in 1942.

Monsanto Appoints J. L. Werner Eastern Representative

John L. Werner of St. Louis has been appointed eastern representative of petroleum chemicals sales for Monsanto Chemical Company's Organic Chemicals Division, it was announced by John L. Hammer, Jr., divisional director of marketing.

In his new assignment, effective March 1, Werner will succeed James B. Irwin who is transferring to the petroleum sales department of Monsanto's Lion Oil Company Division at El Dorado, Ark. Werner will make his headquarters in New York.

A native of St. Charles, Mo., Werner was graduated from the University of Wisconsin in 1941 with a B.S. degree in chemical engineering. He joined the sales department of Monsanto's Organic Chemicals Division in 1946 and has represented the company's petroleum chemicals since that time.

C. F. Craig Elected to U. S. Steel Board

Cleo F. Craig, of Ridgewood, N. J., president of American Telephone and Telegraph Company, has been elected a director of United States Steel Corporation, it was announced by Roger M. Blough, chairman of the board.

Mr. Craig was born in Rich Hill, Missouri. He graduated from the University of Missouri with a B.S. degree in electrical engineering in 1913 and received an honorary LL.D. degree from the University in 1952.

The same year he completed his college education, Mr. Craig started with the telephone company as an equipment man in St. Louis. Advancing through various positions, he became general manager of the long lines department in 1933 and vice president of the long lines department in 1940. He served as vice president in several other departments in the company before becoming its president in 1951. He has been a director of the company since 1949.

Mr. Craig succeeds Myron C. Taylor, who retired from the U. S. Steel board last month.

Gordon W. Reed Elected To Climax Board

Election to the board of directors of Climax Molybdenum Company of Gordon W. Reed, chairman of the board of Texas Gulf Producing Company, has been announced by Arthur H. Bunker, Climax president.

Mr. Reed, a native of Chicago, Illinois, and resident of Greenwich, Connecticut, has had an outstanding career as a business executive and public servant. He became associated with Hanley Company, of Bradford, Pennsylvania, after receiving his Bachelor of Science degree from the University of Illinois in 1922. He was elected a vice president of that organization in 1925 and served in that capacity until 1941. In 1941 Mr. Reed was elected president of Texas Gulf Producing Company and has served as chairman since 1945. He is also a director of Apex Smelting Company, Brockway Motor Company and L. O. F. Glass Fibers Co.

Mr. Reed's public career antedates his career in business. He interrupted his education in 1918 to serve as an enlisted man during World War I. From 1941 to 1945 he served as assistant director of the Aluminum and Magnesium Division of the War Production Board, leaving that post to become special assistant to the WPB chairman. After World War II he served as special assistant to the chairman of the Surplus Property Board and, from 1950 to 1953, was special assistant to the Chief of Staff, U. S. Air Force and has continued as consultant to the Secretary of the Air Force. Mr. Reed served as a director of the American Arbitration Association from 1945 to 1952 and has been a director of Associated Hospital Service of New York since 1947.

Mr. Reed's varied experience, particularly in the oil and gas industry, makes him a valuable addition to the Climax directorate.

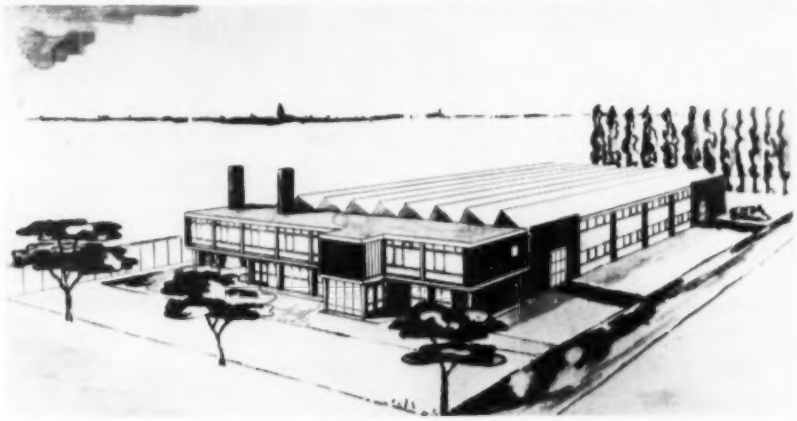
U. S. Steel's Taylor Retires . .

Myron C. Taylor, formerly chairman of the board and chief executive officer, has retired as a director of United States Steel Corporation.

Announcement of Mr. Taylor's retirement was made by Roger M. Blough, chairman of the board.

Industry NEWS

ACHESON BUILDS PLANT IN HOLLAND



Plans to construct the first colloidal graphite manufacturing plant in The Netherlands have been announced by Acheson Industries, Inc., New York, N. Y. Construction and operation of the factory, located near the harbor of Eexta, Borough of Scheemda, will be supervised by Acheson Colloids Limited, the firm's British affiliate. Estimated cost of construction is over 470,000 Dutch guilders, approximately $135,000.

Post-war expansion of Dutch industry, particularly in the electronic, metal-working, and foundry fields, has created a substantial market for colloidal dispersions which are commonly used for general and extreme temperature lubrication, mold coating and parting and forging compounds, impregnation, opaquing and television tube and other electronic applications.

The Scheemda production unit will have sufficient capacity to satisfy all requirements of the Continental market as well as the Dutch. According to Acheson officials, prompt delivery and service will be afforded European industry as a result of by-passing Channel shipping delays.

The new ultra-modern plant will manufacture products paralleling those of other units of Acheson Industries; Acheson Colloids Company of Port Huron, Michigan; Acheson Dispersed Pigments Co., of Philadelphia, Pa.; and Gredag, Inc., of Niagara Falls, N. Y. In addition to the internationally known 'dag' dispersions, these include dispersions of carbon black and other pigments in various media employed by the graphic arts industry.

Need for Better Lubricants Discussed by API

The need for better lubricants, a look at octane requirements, and engine design trends related to fuels, provided the theme for the American Petroleum Institute's Annual Lubrication Committee in Detroit.

The symposium, which was open to the public, was addressed by J. F. Appeldoorn, Section Head, Products Research Division, Esso Research and Engineering Company; Charles M. Heinen, Assistant Managing Engineer, Chemical Engineer Laboratories, of Chrysler Corporation; Raymond I. Potter, Supervisor, Fuels and Lubricants Unit, Ford Motor Company; Dr. L. L. Withrow, Head, Fuels and Lubricants Department, General Motors Research Laboratories; M. L. Hamilton, Assistant Director, Sinclair Research Laboratories; and C. R. Noll, Co-ordinator of Products Application, Gulf Oil Corporation.

Both Appeldoorn and Potter agreed that higher compression and higher-efficiency fuels would be required in the future. "Higher octane will be needed, but will not otherwise have much effect on fuel quality. The same factors in gasoline quality, that were important at lower compression ratios, will still be important at high compression ratio," Appeldoorn said.

Discussing new car improvements Heinen said, "We are required to lubricate more compact, more powerful mechanisms. This reflects itself in four specific requirements, including: greater fluidity at lower temperatures, increased resistance to heat, greater load carrying ability, and compatability with more and more materials."

Heinen pointed out that the problem of sub-standard brake fluids may move rapidly from the position of being a serious problem to that of a critical one. At present, seven states have recognized it and have included legislation banning the use of anything but a heavy-duty brake fluid for sale. He urged the general public to use heavy-duty brake fluid as a safety measure.

In conclusion, Noll called for more satisfactory multi-purpose gear lubricants and improvement in the quality of rear axle lubricants. He said that new improved lubricants would probably cost the oil industry more to manufacture.

API Publishes Consumer Purchasing Habits

A new study which shows where motorists take their cars for oil changes and lubrication jobs, and indicates the

intervals at which these services are performed and the reasons why, has just been published by the Division of Marketing of the American Petroleum Institute.

Entitled "Motor Oils and Lubrication: A Study of Consumer Purchasing Habits," the study is complete with a series of tables blanketing the country and taking geographical preferences and differences into account. It provides much worthwhile data for marketers and others interested in petroleum's operations.

"This information is broken down by year-model of the motorists' cars, the average mileage on the cars, household income, and other data," it was announced by Adam J. Rumoshosky, Director of the Marketing Division.

"It is based on a series of special questions on motor oil and lubrication which the Division's Marketing Research Committee had included in the Crowell-Collier 1955 Automotive Survey. A total of 4,165 interviews, conducted in May and June of 1955 form the basis of the study."

He emphasized that the study is expected to be of particular interest and value to personnel in advertising, sales promotion, and merchandising departments of oil companies, as well as to marketing research people generally.

Copies of the study may be obtained from the Marketing Division, American Petroleum Institute, 50 West 50th St., New York 20, N. Y., at $1.25 each for API members and employees of companies contributing to the API, and $2.50 each for all others.

Checks or money orders should accompany all orders amounting to $5.00 or less, Rumoshosky said.

Chemicolloid Laboratories, Inc., Plans Tour of European Markets

Plans for a four-week tour of Europe have been announced by Chemicolloid Laboratories, Inc., manufacturers of the Charlotte Grease Mill.

Due to the increasing demand for the Charlotte Colloid Mill abroad, David F. O'Keefe, President, and Leroy E. Putnam, Vice President, will meet with groups representing the Petroleum, Chemical, Pharmaceutical, Textile and Food Industries to discuss processing problems, requirements and servicing.

Of particular interest will be their contacts with leading grease manufacturers in England, Ireland, France and Switzerland where considerable interest has been shown in the Charlotte Grease Mill, already in extensive use throughout the United States and Canada.

Consistent with their standing in the colloid mill field, Chemicolloid Laboratories, who have manufactured, distributed and serviced the Charlotte Colloid Mill over the past thirty years, recently enlarged their facilities in Garden City Park, New York. Since the completion of their new plant, where they have consolidated Executive, Sales and Engineering Departments, Chemicolloid has been developing and expanding in many fields of application for the Charlotte Colloid Mill.

New Literature on Wheel Bearing Grease Tester

Precision Scientific Company has published "Bulletin 718" on the redesigned Wheel Bearing Grease Tester, an apparatus for determining the leakage tendencies of wheel bearing greases according to the ASTM method. In addition to the ASTM test, the bulletin discusses tests for changes in grease characteristics under simulated service conditions. Also described are such features of the apparatus as forced air convection and a hydraulic thermostat which holds the spindle temperature within 2.5% at the test temperature of 220% F.

"Bulletin 718" will be sent on request. Write Precision Scientific Company, 3737 W. Cortland Street, Chicago 47, Illinois.

Desk and Derrick Plans Fifth Annual Convention

Convention plans for the fifth annual convention of the Association of Desk and Derrick Clubs of North America, which will be held on September 7-8, 1956, in New Orleans, were discussed by the Board of Directors of the Association at its Spring meeting in Kansas City on February 17 to 19. Mrs. Bettie Conley, of the Estate of William G. Helis, New

Orleans, has been announced as Convention General Arrangements Chairman.

The convention theme adopted by the Board of Directors is, "Greater Knowledge—Greater Service." This theme was first used at the Association's second convention in Denver in 1953, and the decision to again use it was based on the feeling that it completely expresses the purpose of Desk and Derrick, which is to promote among its members, through increased knowledge, a greater understanding of the industry and its problems, to the end that the knowledge gained thereby will increase the members' scope of service to their employers.

An attendance of from 1,500 to 2,000 members, from the 108 clubs which make up the Association throughout the United States and Canada, is expected at the New Orleans convention.

Continental Can to Expand In California

R. L. Perin, executive vice president of Continental Can Company's Metal Division, has announced that Continental has made arrangements with the Southern Pacific Company to acquire about 40 acres of industrial property in San Leandro, California, for future development.

The San Leandro property, he explained, will make possible future expansion of facilities for manufacture of metal containers. Definite plans will be forthcoming for construction of new facilities which is expected to commence in 1957.

C. D. Lafferty, manager of industrial development for Southern Pacific, says the 40 acres, which the railroad will transfer to Continental Can, front on the east side of Alvarado Street, in San Leandro and lie along the Southern Pacific main Niles Canyon line, just south of the present plant of Western Corrugated Box, Inc.

Battelle to Conduct Molybdenum Chemical Research

Battelle Institute, Columbus, Ohio, will conduct for Climax Molybdenum Company certain phases of an expanded molybdenum chemical research program now under way at Climax, according to a joint announcement by Clyde Williams, Battelle president, and Alvin J. Herzig, Climax vice-president—research, and president of the subsidiary company, Climax Molybdenum Company of Michigan, which concluded the agreement.

Under the terms of a one-year contract, Battelle will conduct research aimed at finding new applications for existing molybdenum chemicals.

In detailing Battelle's research activities under the new contract, Mr. Herzig emphasized that they will supplement the expanded research program now being conducted at Climax's Detroit Research Laboratories. There a new chemical group is currently concentrating on investigation of organomolybdenum compounds and molybdenum chemicals used as catalysts, corrosion inhibitors, and lubricant additives.

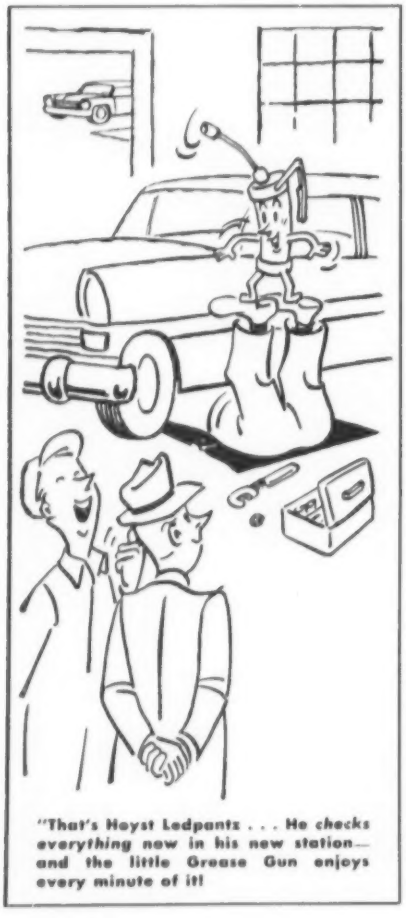
Current high interest in molybdenum chemistry, Mr. Herzig stated, is but a reflection of a general renaissance of inorganic and, particularly, metal chemistry, which until recently, has been somewhat overshadowed by developments in the field of organic

chemistry. He credited great technological advances in such fields as nuclear energy and jet and rocket propulsion with rekindling interest in the potential of inorganic materials, superalloys and the protection of super alloys against corrosive environments.

Climax's program at its Detroit Laboratories illustrates the trend, Mr. Herzig said. Originally founded to do metallurgical research, primarily for the automobile industry, the Laboratories in the past few years have taken on more and more projects involving chemical uses for molybdenum. Last year when Climax formally launched a chemical development program, chemical research was given major stature and a chemical research group established to explore the potential of molybdenum chemicals.

Moly-Sulfide Lubricant Additive Makes Improvements

Mechanic points to the excellent condition of a bushing after 160,000 miles of service in a heavy-duty truck



"That's Hoyst Ledpantz . . . He *checks everything* now in his new station—and the little Grease Gun enjoys every minute of it!

trailer torsion suspension unit lubricated with a chassis grease containing 3% Moly-Sulfide additive. A duplicate bushing on the right, which was lubricated with standard chassis grease, has score marks, broken threads and extensive wear on the barrel after 35,000 miles in service.

Moly-Sulfide's unusual adherence to metal surfaces combined with its low coefficient of friction and low resistance to shear makes the difference.

American Potash Increases Western Offices

American Potash & Chemical Corportion has announced plans to set up district sales offices in March at San Francisco, Calif., and Portland, Ore., to augment the company's sales activities in the western states.

The chemical company's San Francisco sales office, which will be located in the Russ Building, will handle sales in northern and central California, as well as Nevada, Utah and Colorado. The Portland sales office will cover Oregon, Washington, Idaho, Montana, Wyoming and British Columbia.

Announcement of the plans was made by William M. Clines, western sales manager, who said that opening of regional offices was a part of the company's current development and expansion program.

Rod Taft, previously supervisor of potash sales, will be transferred from Los Angeles to San Francisco as district sales manager, while Paul F. Staub has joined American Potash & Chemical Corporation as Pacific Northwest district sales manager, operating from Portland. Staub previously was district manager in Portland for L. H. Butcher Company for 10 years, and, prior to that, was with General Chemical Division of Allied Chemical and Dye for 11 years as salesman and assistant sales manager of the General Chemical offices at San Francisco.

Recent additions to American Potash & Chemical Corporation's product lines include lithium hydroxide from its subsidiary, American Lithium Chemicals, Inc., at San Antonio, Texas; and chlorate and perchlorate chemicals from the recently-acquired Western Electrochemical Company, Henderson, Nev., which has been renamed American Potash & Chemical Corporation (Nevada). In addition, the company manufactures more than 50 products of various types for use in industry and agriculture.

New, Improved Models of Cowles Dissolvers Announced

Announcement of new, improved models of Cowles Dissolvers and an expanded plan for demonstration in users' plants without obligation to buy has just been made by D. L. Grubbs, Vice President and General Manager of Morehouse-Cowles, Inc., National Distributors for Morehouse Mills and Cowles Dissolvers.

The new models feature motor placement that substantially reduces head-room requirements on many of the models, stainless steel construction that eliminates risk of contamination, patented impellers for a wide variety of applications in the process industries and other advancements. Peripheral speeds of impellers range from 3600 to 6000 R.P.M., producing extreme sheer and impact.

Cowles dissolvers are designed for processors of liquid-liquid, gas-liquid and solid-liquid products. They are

applicable to materials with viscosities up to and in excess of 50,000 centipoises, including paints, inks, chemicals, foods, plastics and similar materials. Many models are available from large volume units to laboratory and small batch types. Engineering for special adaptations can also be supplied.

Demonstrations will be made in processors' own plants, on their own products at the sellers' risk without obligation to buy. Morehouse Mills will be demonstrated on the same basis, separately or in conjunction with Cowles Dissolvers. For complete information write Morehouse-Cowles, Inc., 1150 San Fernando Road, Los Angeles, Calif.

Foote Mineral Negotiating With Electro Manganese

Approval has been given by the Board of Directors of Foote Mineral Company, Philadelphia, and Electro Manganese Corporation, Knoxville, Tennessee, to the issue of 169,178 shares of Foote common stock in exchange for the net assets and business of the Knoxville electrolytic manganese metal producer. This is equivalent to a share-for-share exchange. Negotiations between the two companies have been in progress for some months.

Final approval of the transaction is contingent upon approval of the stockholders of Electro Manganese at a special meeting to be held on March 12, 1956, and consent to assignment of a certain contract which Electro has with the General Services Administration of the U. S. Government.

Foote is a long established company which manufactures and markets over fifty different products to the metallurgical, ceramic and other trades. It mines, processes and sells many kinds of lithium products, of which it is the world's largest producer. Its lithium mines are in Kings Mountain, N. C., and its chemical plants are at Sunbright, Virginia, and Exton, Pennsylvania. It maintains a Research Department at Berwyn, Pennsylvania, and its general offices are in Philadelphia.

Foote had net sales in 1955 of $15,309,078—a new record for the company, and earnings were $902,841,— equivalent to 92c per share after preferred dividends. Earnings were reduced by unusually high costs associated with the start-up of new equipment under a major expansion program. Foote's profits have improved substantially over this rate in the last few months and the improvement is expected to continue throughout 1956.

Electro Manganese, the majority of whose shares are held by residents of Minneapolis, is the world's pioneer and largest producer of pure manganese metal, by an electrolytic process which it brought to commercial success at Knoxville, Tennessee. Commercial production was achieved in 1941, and successive expansions have brought production to twelve times the original volume. Its two plants are located in Knoxville. Its product is used principally in alloying steel and other metals. Sales in 1955 were $4,130,521. Earnings amounted to $383,261 or $2.26 per share after preferred dividends.

If the plan is approved by the shareholders of Electro, and the necessary consent to assignment is secured from the General Services Administration, Foote intends to continue the business of Electro as a Division maintaining the existing employment and community and customer relations.

By means of the proposed exchange of shares Foote will, according to the statement of Gordon H. Chambers, Chairman of the Board, add a new product to its line which will augment its current diversified position, secure the services of a staff of engineers and chemists experienced in the field of electrochemistry, and improve its services to the consuming industries.

Mr. Russell H. Bennett, Chairman of the Board of Electro, is expected to be elected to the Board of Foote. He has expressed to the shareholders of Electro the view that his company, which has been a one-product enterprise, will secure a desirable diversification and will obtain the services of a fully integrated Research and Development Department. The stockholders of Electro will be provided with an established market for their shares, which has heretofore been unavailable to them since Electro's shares are closely held in large blocks.

Archer-Daniels-Midland Announces New Product

Another new product is now avialable from the Archer-Daniels-Midland Company's fatty alcohol plant

in Ashtabula, Ohio.

The new fatty alcohol, known as ADOL 40, is a highly stable, long chain (C_{18}) unsaturated fatty diol. It has three chemically reactive positions, two Hydroxyl groups, one on a terminal carbon atom and the other on the 12th carbon, and one double bond.

ADOL 40 is readily soluble and is an excellent solvent for chemicals. It is a clear, liquid, non-drying alcohol. The cloud point is below 10°F.

Available for the first time in tank-car or LCL quantities, ADOL 40 offers unlimited reaction possibilities in the manufacture of cosmetics, polyester modifiers, surfactants and quaternary derivatives.

ADOL 40 is one of many new fatty alcohols being produced at ADM's Ashtabula plant, which began production last June. The headquarters for the ADM Chemical Products Division is 2191 West 110th Street, Cleveland 2, Ohio.

Archer-Daniels-Midland Readies Products

UNADOL 40 and UNADOL 90—unsaturated alcohols with two or more double bonds and one hydroxyl group—are now available in tank-car quantities from Archer-Daniels-Midland Company, Chemical Products Division, 2191 West 110th Street, Cleveland 2, Ohio.

The new fatty alcohols are non-corrosive, almost water-white liquids derived from domestic vegetable oils such as linseed oil and soybean oil. They are oily liquids that resemble in appearance the oils from which they are derived, although they have less odor and are lighter in color.

The principal component of UNADOL 40 is linoleyl alcohol which possesses two double bonds. The principal component of UNADOL 90 is linolenyl alcohol which possesses three double bonds.

Successful product advantages are very likely in manufacturing new protective coatings, resins, surface active agents and chemicals.

UNADOLS 40 and 90 are among the many new saturated and unsaturated fatty alcohols which are being made commercially available for the first time from ADM's new Ashtabula, Ohio plant.

FUTURE MEETINGS of the Industry

APRIL, 1956

2-4 American Institute of Electrical Engrs. (Southwest District No. 7), Dallas, Texas.

4-6 American Society of Lubrication Engineers (annual meeting), William Penn Hotel, Pittsburgh, Pa.

8-13 American Chemical Society, Dallas, Texas.

14-18 Petroleum Equipment Suppliers Association of America, Boca Raton Hotel, Boca Raton, Fla.

16-20 Greater New York Safety Council (annual convention and exposition), Statler Hotel, New York, N. Y.

18-20 National Petroleum Association (semiannual meeting), Cleveland Hotel, Cleveland, Ohio.

22-26 National Tank Truck Carriers, Inc., Shoreham Hotel, Washington, D. C.

29-
May 1 Independent Petroleum Association of America (semiannual meeting), Statler Hotel, Los Angeles, Cal.

30-
May 2 Chamber of Commerce of the United States (annual meeting), Washington, D. C.

30-
May 4 American Petroleum Institute (safety and fire protection midyear meeting), Warwick Hotel, Philadelphia, Pa.

MAY, 1956

13-15 Empire State Petroleum Association, Statler Hotel, Buffalo, N. Y.

13-15 Pennsylvania Petroleum Association, Bedford Springs Hotel, Bedford, Pa.

14-17 American Petroleum Institute (Division of Refining, 21st midyear meeting), Sheraton Mount Royal Hotel, Montreal, Canada.

21-23 American Petroleum Institute (Division of Marketing, midyear meeting), Atlanta Biltmore, Atlanta, Ga.

23-26 American Petroleum Institute (Division of Marketing, Lubrication Committee), Broadmoor, Colorado Springs, Colo.

JUNE, 1956

3-8 SAE Summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

4-8 National Fire Protection Assn. (60th annual meeting), Statler Hotel, Boston, Mass.

12-13 Petroleum Packaging Committee, Statler Hotel, Boston, Massachusetts.

17-22 ASTM 59th Annual Meeting and 12th Apparatus Exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J.

21-22 Western Petroleum Refiners Association (regional meeting), Broadview Hotel, Wichita, Kansas.

25-29 American Institute of Electrical Engrs. (1956 Summer & Pacific general), San Francisco, Calif.

SEPTEMBER, 1956

7-8 Desk & Derrick Club, New Orleans, La.

12-14 National Petroleum Association (annual meeting), Traymore Hotel, Atlantic City, N. J.

13-14 Petroleum Packaging Committee, Chicago, Illinois.

16-21 American Chemical Society (130th annual meeting), Atlantic City, N. J.

16-22 ASTM 2nd Pacific Area National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles, Calif.

19-21 National Industrial Conference Board (marketing meeting) Waldorf-Astoria Hotel, New York, N. Y.

20-21 Mid-Continent Oil & Gas Assn. (membership meeting La.-Ark. Division), Roosevelt Hotel, New Orleans, La.

24-25 IOCA Ninth Annual Meeting, Bismarck Hotel, Chicago, Ill.

OCTOBER, 1956

1-3 Texas Mid-Continent Oil & Gas Association (annual meeting), Rice Hotel, Houston, Texas.

1-5 American Institute of Electrical Engrs. (1956 Fall general), Morrison Hotel, Chicago, Ill.

14-20 American Petroleum Institute Oil Progress Week.

17-19 National Industrial Conference Board (atomic energy meeting), Waldorf-Astoria Hotel, New York, N. Y.

22-24 NLGI ANNUAL MEETING Edgewater Beach Hotel, Chicago, Ill.

29-30 Independent Petroleum Association of America (annual

meeting) Statler Hotel, Dallas, Texas.

NOVEMBER, 1956

1-2 SAE National Diesel Engine Meeting, Drake Hotel, Chicago, Ill.

8-9 SAE National Fuels and Lubricants Meeting, The Mayo, Tulsa, Okla.

12-15 American Petroleum Institute (36th annual meeting), Conrad Hilton & Palmer House, Chicago, Ill.

26-30 National Exposition of Power and Mechanical Engineering (ASME), New Coliseum, New York, N. Y.

27-30 American Chemical Society (9th National Chemical Exposition), Cleveland, Ohio.

APRIL, 1957

16-18 National Petroleum Association, Cleveland, Ohio

JUNE, 1957

16-21 American Society for Testing Materials, Chalfonte-Haddon Hall, Atlantic City, N. J.

SEPTEMBER, 1957

11-13 National Petroleum Association, Atlantic City, N. J.

OCTOBER, 1957

28-30 NLGI ANNUAL MEETING Edgewater Beach Hotel, Chicago, Ill.

APRIL, 1958

16-18 National Petroleum Association, Cleveland, Ohio

JUNE, 1958

22-28 ASTM 61st Annual Meeting, Hotel Statler, Boston, Mass.

SEPTEMBER, 1958

10-12 National Petroleum Association, Atlantic City, N. J.

OCTOBER, 1958

27-29 NLGI ANNUAL MEETING Edgewater Beach Hotel, Chicago, Ill.

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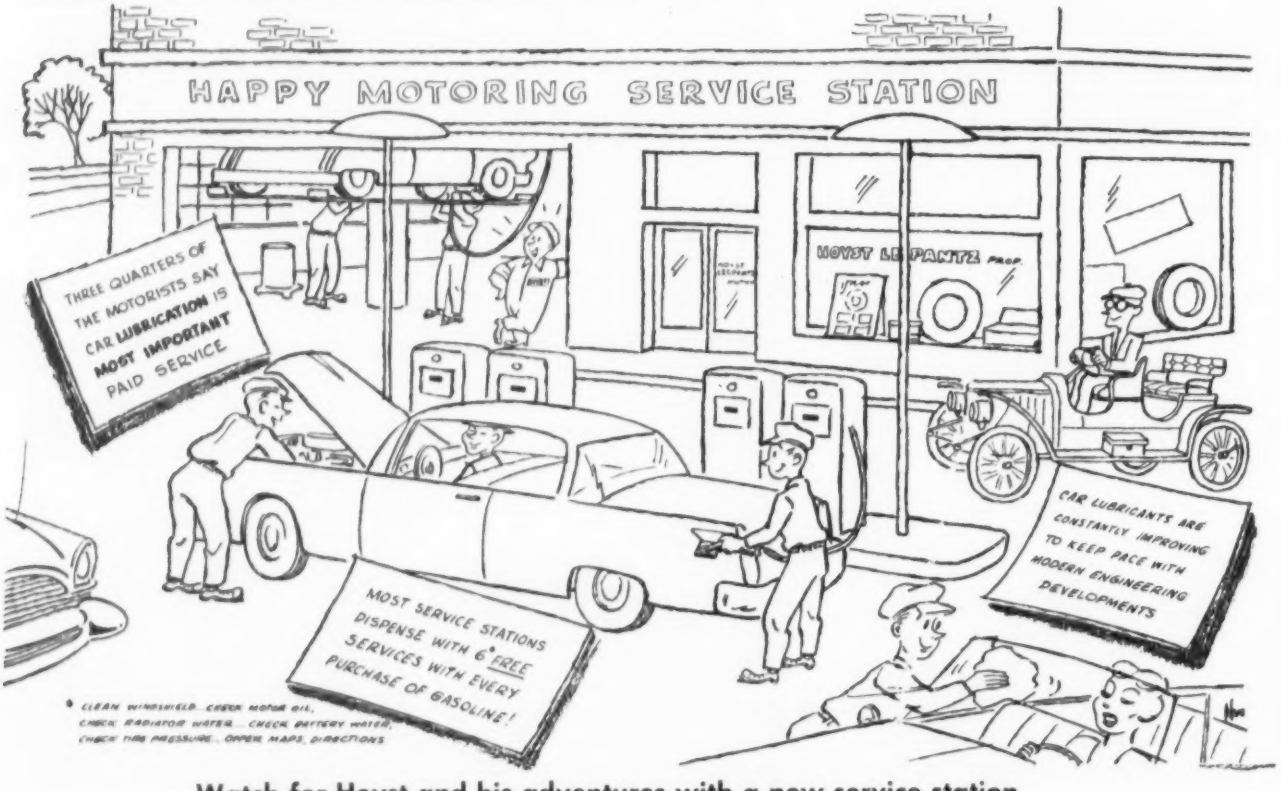

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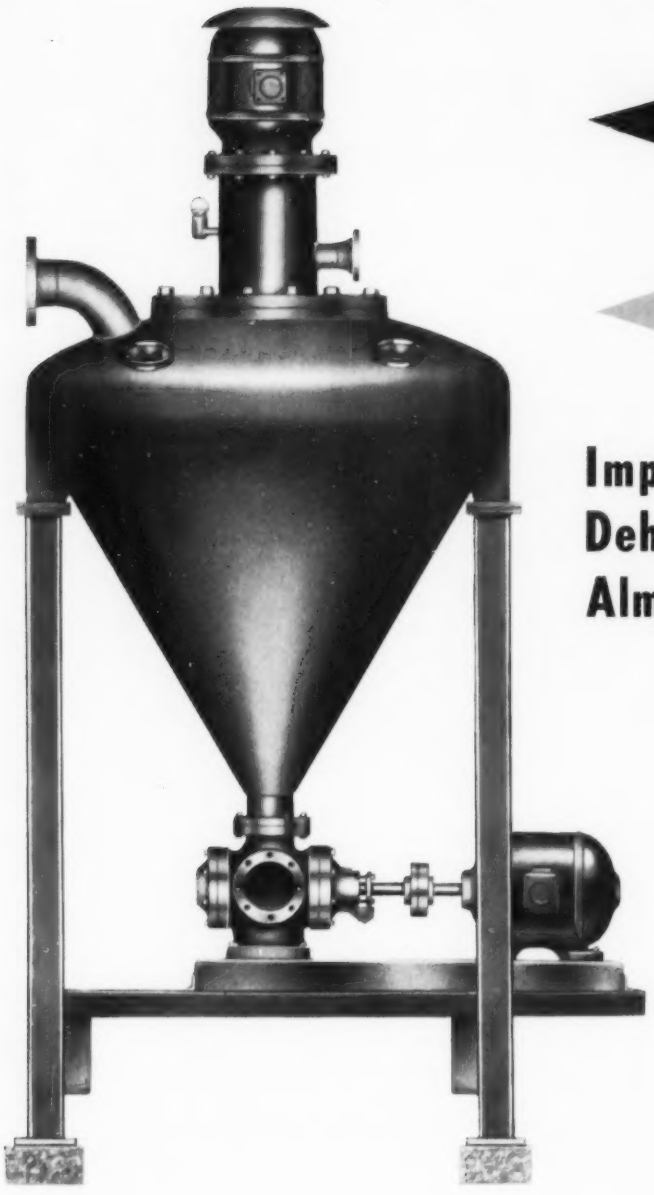

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